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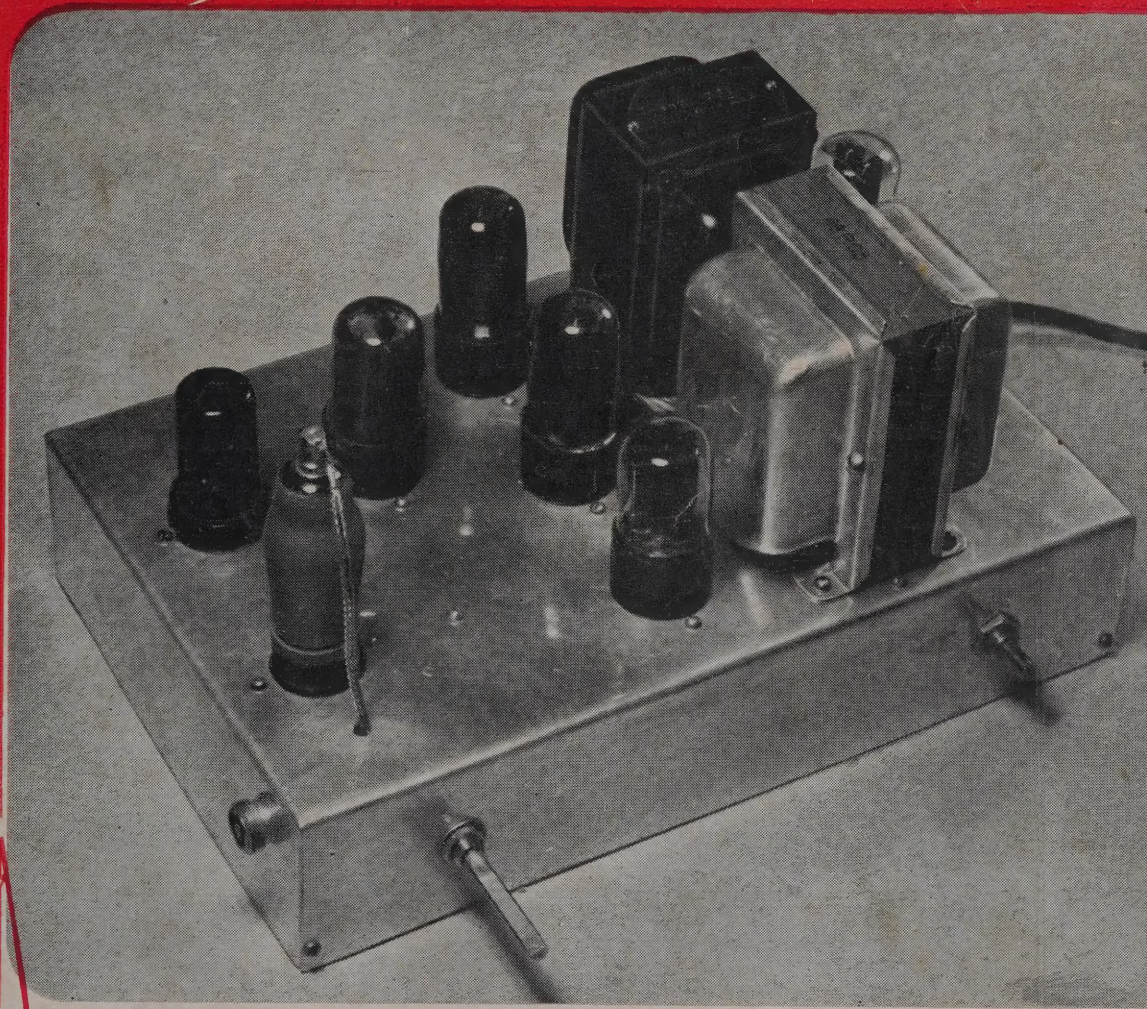

DECEMBER 1, 1950

VOL. 5, NO. 10

1/10

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RADIO and ELECTRONICS

Vol. 5, No. 10 December 1st, 1950

OUR COVER

This month's cover illustrates the low-powered high-quality amplifier described on page 4 of this issue.

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AUSTRALIAN READERS PLEASE NOTE

An announcement of particular importance to Australian readers will be found on page 44 of this issue.

CORRESPONDENCE

All correspondence, contributions, and inquiries referring to advertising space and rates should be addressed to:—

The Editor,
"Radio and Electronics,"
Box 22,
Government Buildings P.O.,
WELLINGTON.

OFFICES AND LABORATORY:
Radio and Electronics (N.Z.) Ltd.,
46 Mercer Street, Wellington.
TELEPHONE:
Wellington 44-919.

AUCKLAND REPRESENTATIVE:
Mr. J. Kirk,
No. 11 Keans Building,
150 Queen St., Auckland.
Telephone 48-113. P.O. Box 401.

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So Far And Yet So Near

October 1950 bids fair to being remembered as the month when television first poked its head round the "corner" that people have been talking about for so long. The New Zealand Radio and Television Manufacturers' Federation, as reported elsewhere in this issue, agreed at their annual conference that TV was to be opposed no longer—that it would be a "good thing" for the New Zealand radio industry, and that the R.T.M.F. would do all in its power to bring TV to the public of our country as soon as possible. This in itself is a great step forward, and reflects considerable credit on the manufacturers, who after all have had more than a little justification for believing in the past that the coming of TV would mean a very lean and difficult period for the industry.

Of course, we have still had no definite pronouncement from the Government as to their plans for TV, but judging by the newly-found enthusiasm of the Minister of Broadcasting for TV, a statement can be expected at an early date. In fact, Mr. Doidge has said publicly that as soon as the Government has received the views of its technical experts on the subject, a statement will be forthcoming.

For those of us who are keen to become technically acquainted with TV at first hand, this is very good news. But there are numerous things which could prevent the Government from favourably considering the institution of a TV service. Of these, perhaps finance will be the greatest deterrent, in spite of the fact that the cost of capital equipment is lower than previously, and will probably be lower yet. However, a service run by the Government, in the person of the Broadcasting Service, is not the only solution. If the public purse will not stand the drain, there may be, and probably are, firms who would be prepared to initiate TV brodacasts. There is no good reason why private enterprise should not be allowed to do something about it if the Government does not wish to itself. In fact, there is reason to believe that if left to private enterprise, the pioneering work may be done much sooner than if the Government pursues a policy of waiting. True, we do not yet know what the Government policy will be, but if it is as progressive as the present outlook of the Minister of Broadcasting, then we can expect to see some action, and in the not too distant future. Having poked its head round the corner, it is much to be hoped that TV does not summarily withdraw it again!

The "R. and E." High-Quality Pick-up

In the November issue of this journal we published a letter from Dr. A. G. Bogle, purporting to prove that the pick-up described in the July 1950 issue cannot work. Dr. Bogle's argument is based on the assumption that fringing effect can be neglected, and if this assumption were justified, his remarks would be quite true. However, the gaps between the armature and the pole-pieces are so wide that fringing cannot be neglected, and as a result, the reluctance of the magnetic circuit will not be constant. Dr. Bogle's explanation is no doubt true when applied to a small portion of the armature, and explains why the armature spacing (the distance between the armature and the poles) has only a slight effect on the output voltage, but since the armature is not small with respect to the pole-pieces, and since, further, the gaps are not small with respect to either the armature or the pole-pieces, it seems evident enough that the fringing effect must be large, and certainly not negligible. This being the case, the flux in the magnetic circuit will follow the inverse square law, and there will be a first order output voltage.

If Dr. Bogle's explanation were the right one, the pick-up would, as he suggests, have an output that was so highly distorted as to be useless. Such is not the case, however, since the output waveform has been found by experiment to be exceptionally pure. Similarly, if the output obtained were due to the vertical compliance, it could be expected to be badly distorted, since the record is not vertically cut. It would appear, therefore, that our correspondent has fallen into a trap, in that the apparently obvious mechanism is not the true one.

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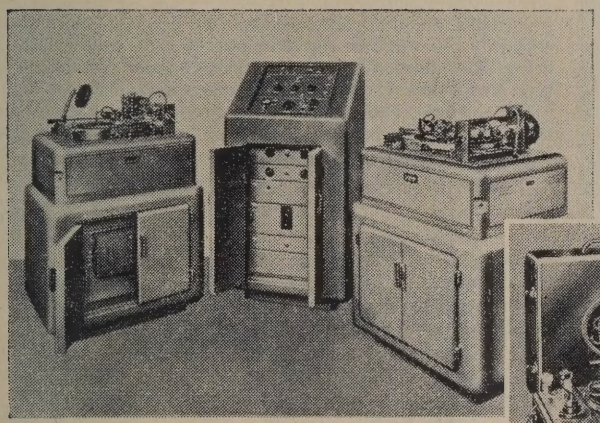

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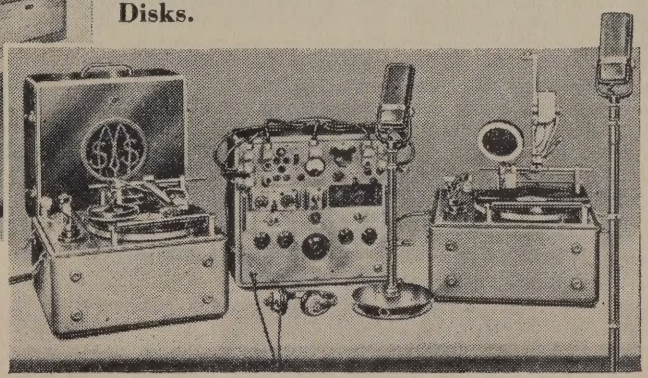

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BUILDING THE "LOW-POWERED HIGH-QUALITY AMPLIFIER"

In the August 1950 issue of this journal, we described the circuit of an amplifier which has all the characteristics of much more powerful and costly amplifiers—except their large power output. The amplifier uses triode-connected 6V6s in the output, to give an undistorted output of 4 watts; its power supply is therefore quite a light one, and this makes the amplifier much less costly than a high-powered one, while being in no way inferior in other respects.

INTRODUCTION

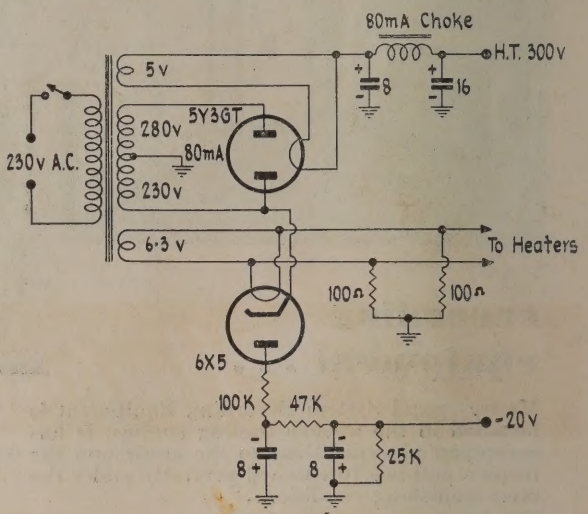
When the circuit of this amplifier was originally designed and tried out in "bench" form, and the circuit was described in the August 1950 issue of this magazine, it was mentioned in the article that Part II, to be forthcoming, would feature constructional details. Unfortunately, we have been unavoidably delayed in doing this on account of the non-availability of a suitable high-quality output transformer. Existing transformers were all designed for considerably higher power output, or else were hardly of high enough quality to suit the undoubtedly excellent performance of the amplifier itself. However, we have pleasure in reporting that suitable transformers are now to be had, of excellent quality, and at a much lower price than one would have to pay for a transformer to cope with the output from a high-powered amplifier. The particular transformer referred to is by a well-known manufacturer and is a high-quality component for matching push-pull 6A3s in Class A to one of the almost universal 15 ohm loudspeakers that have become so popular of late.

THE POWER SUPPLY

The original circuit did not give details of a suitable power supply for the amplifier, but only the amplifier circuit itself. Our first job, therefore, in completing the story, is to describe the power supply circuit that has been used in building the circuit in final form. The circuit is very simple, but is unusual in including a negative voltage source, for supplying the fixed bias for the push-pull triode-connected 6V6 output tubes. The power transformer is a 280v.-a-side 80 ma. one, used with a 5Y3-GT rectifier for the main H.T. Condenser-input filtering is employed, with an input condenser of 8 μf., and a smoothing condenser of 16 μf. This supplies the output tubes, and the push-pull driver tube directly, and additional smoothing is obtained as well as re-coupling by means of an R.C. filter in the H.T. line to the first two valves, the EF37 voltage amplifier and the 6J5 phase inverter.

The grid bias needed for the triode-connected 6V6s is between 18 and 20 volts. The supply need not have good regulation, because the valves do not draw grid current under any condition except that of overload, which we hope users will avoid in any case. Thus, a 6X5-GT rectifier is used in a simple series circuit, with its heater fed from the single 6.3 volt winding of the power transformer, and its cathode from one side of the H.T. winding. These conditions of service are quite satisfactory for the 6X5, because the rated heater-cathode voltage is not exceeded, and because this aspect is assisted by the large resistor between the valve's plate and the first smoothing condenser. The output of the rectifier is particularly hum-free, because the D.C. output current is so slight, and because we have virtually a two-section filter. The purpose of the 100k. resistor is to cut down the maximum voltage produced, and to eliminate the need for an adjustable voltage divider. If the output voltage is too small, the 100k. can be decreased, and vice-versa if the voltage obtained is too high.

Because electrolytic condensers are used in the smoothing circuit, it may be found that the bias voltage is not just what the diagram specifies. If not, this will almost certainly be due to the leakage of the condensers not being the same as that of the ones used in the prototype amplifier. If with the values shown, the voltage is much too low, and the resistors check at the right values, then the condensers can be suspected of excessive leakage, and should be replaced, one by one until the culprit is found. It should be pointed out that many electrolytics have too much leakage for a circuit like this, but are still perfectly good condensers, as long as the extra current drain can be tolerated. Leakage does not in general impair their efficiency as smoothing devices. In a comparatively high-resistance circuit, as here, however, electrolytics with more than average leakage may have to be replaced, simply in order to increase the bias voltage. It is important not to increase the value of the 25k. resistor as a means of raising the bias voltage, because this increases the resistance in series with the 6V6 grid circuit, and as with all fixed-bias stages, this should be kept down as low as possible. Another point to note is the way in which the heater winding is earthed. It is advisable to centre-tap the winding with low-value resistors in the manner shown because of the connection of the 6X5 to the winding. It means, of course, that two wires will have to be run in the heater circuit, but this is the best practice in any case, and it allows the point at which the heater is earthed to be altered at will, to suit existing circumstances. It is best to place the 100-ohm resistors at the heater pins of the EF37, and to earth the centre-tap at the common earth point for this stage. This ensures that stray heater currents through the chassis cannot flow in the grid-cathode circuit of this valve, which, being a high-gain one, is more prone to introduce hum than any of the others. The EF37 itself can almost be ruled out on this score, because it is of special construction, but the wiring of the input circuit can introduce hum even with a perfect

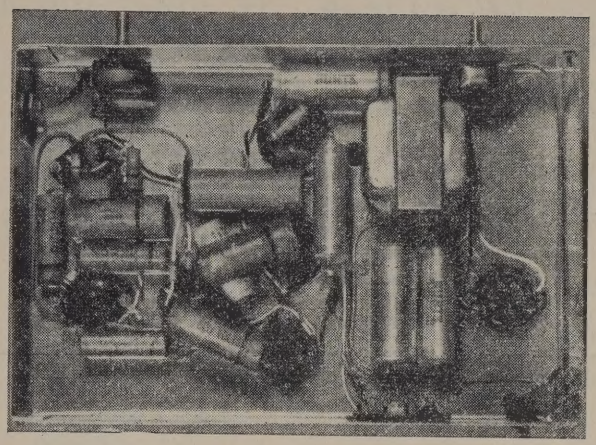


valve, if this wiring is not properly done. The use of a single earth point for the stage, combined with the recommended method of heater earthing, will ensure freedom from this kind of hum.

CONSTRUCTION OF THE AMPLIFIER

The cover picture this month is a view of this amplifier as constructed in our laboratory, and shows clearly the simple lay-out of the amplifier, complete with the power supply. In the front left-hand corner is the EF37, with the gain control and input connector close handy on the front and side of the chassis respectively. Behind this is the 6J5 phase inverter, while the two back tubes of the remaining three that can be seen are the 6V6s, conveniently close to the output transformer, which is the black one at the back. The other valve on the left of the power transformer is the 6X5 bias rectifier, while the 5Y3-GT can just be glimpsed at the back between the power and output transformers. The control shaft at the right-hand end of the chassis, balancing the volume control in position, is simply an A.C. on/off switch.

The small photograph on this page is an underneath view of the amplifier, with the front of the chassis at the top of the picture so that left and right correspond to the same sides in the top view. While the top view might lead one to suppose that the amplifier was a little spread out, the underneath view shows that there is not really too much room, although there is no overcrowding either. Towards the right of the picture is the 80 ma. smoothing choke, with the smoothing condensers directly in front of it. The socket in the clear to the right of these condensers is that of the 5Y3 rectifier. On the back of the chassis is a socket for the speaker, and a grommet for the power cord. Beside this, right in the corner, is a small tag strip on which the power cord's leads terminate. This is an easy and neat way of terminating the power cord that gives little chance for short-circuits to develop, and does not re-



quire such wiring horrors as a taped-up power cord end in order to prevent them.

The wiring is very straight forward, almost all the small parts terminating on the appropriate valve socket lugs. The chassis measures 10½ in. x 7½ in. x 2 in., and was made of 18 gauge aluminium sheet, which proved quite rigid enough in spite of its comparative thinness. We have not given a working drawing for the chassis, since this is so simple that a detailed drawing is hardly required.

CHOICE OF THE FEEDBACK RESISTOR

In the first instalment of this article, mention was made of the fact that the value of the feedback resistor could not be specified exactly until a suitable output transformer had been wired into the circuit. Actually, it could have been, except for the fact that it is much better to check such things under actual working conditions. The resistor finally used was one of 50k., ½-watt, and this gave a gain reduction of approximately 3.5 times, without any sign of instability at all. This is the last piece of information needed, and we suspect that a good many of our readers will accordingly be trying out high quality at low power output for themselves, if only to see what practical difference it makes to have only 4 watts rather than about fifteen up one's sleeve, as it were.

TV DISCUSSED AT THE N.Z. RADIO AND TV MANUFACTURERS' FEDERATION CONFERENCE

In opening the discussions on television, the President reviewed the work of the Executive to date. The Executive, he said, had met the Government's television Advisory Committee on two occasions, and had found this body co-operative. The Executive, however, had little faith in the effectiveness of the committee, which seemed rather to be seeking information, than to have concrete ideas of its own on the subject. The Committee was told that the Federation believes that there is no technical reason why TV cannot be brought to this country now, rather than at some indefinite date in the future. It had also stressed its conviction that the radio industry could meet the advent of TV by producing the receivers that would be needed, and that there was thus no reason to suppose that TV receivers would have to be imported. In spite of this, the advisory committee questioned the ability of the industry to supply the local market with TV sets when the time came.

The committee had, however, asked the Federation to state its views on technical standards for TV in this country.

In the ensuing discussion, Mr. P. C. Collier said he believed that the manufacturers, as a body, should bring to bear as much pressure as possible to have a TV service instituted in New Zealand. The most important first step, he said, was to have an authoritative pronouncement made as to the probable time for implementing such a service, and as to the Government's intentions generally with regard to TV. The art was so well advanced at the present time that experimental transmissions were quite unnecessary and if indulged in on a more or less sporadic basis, would have a very harmful effect on the public reaction to the first TV broadcasts. There was no reason, Mr. Collier said, why a coherent scheme, allowing for normal expansion, should not be commenced from the start.

Mr. Blackwell, enlarging further on his own views on TV, said that while in the U.S.A. recently, he had made it his business to gather as much information as possible on the early effects of TV on the radio industry. Many parts of the U.S.A. were in a similar position to New Zealand, in that locally, TV had not started, and as a result of experience many times over, all those who were concerned in a similar way to how we are now had expressed the opinion that it was useless to oppose the advent of TV. Experience had shown that while the coming of TV to an area did undoubtedly produce a recession in the sales of sound broadcast receivers, this was in every case only a temporary occurrence. There seems to be only one way in which to disabuse the public of the mistaken idea that TV supplants ordinary broadcasting, and that way is to give the people TV and let them find out the true state of affairs for themselves. Experience had shown further that in all cases, the sales of ordinary radio sets in an area which had just experienced TV for the first time gradually returned to normal. The overall picture in the U.S.A. at present, said Mr. Blackwell, is that in spite of the millions of TV sets being produced, ordinary radio sets were being made and sold in as great quantities as ever before.

From a long-term point of view, therefore, the industry here had nothing to fear, and everything to gain from television. One of the interim difficulties is that dealers and distributors tend to magnify the public fear that their radio sets will become obsolete, proving that these people were as much in need of the true facts of the case as the public itself. It was therefore vitally important that not only the public, but also the dealers and distributors, should be presented with the true facts. Nothing we can do will prevent TV obtaining publicity in the press and elsewhere, but what the Federation must and can do is to see that the TV publicity that occurs is of the right sort. The previous attitude of the Federation, now outdated by events, had been that any TV publicity was harmful. This attitude had been engendered partly because so much of the TV publicity that had been given really was harmful to the industry; the Federation should, Mr. Blackwell considered, take steps to prepare its own publicity material on TV, and have it published as widely as possible, particularly with the object of removing the popular misconceptions which could be so damaging to the industry.

Similar sentiments were expressed by other speakers, notably Mr. G. A. Wooller and Mr. T. J. F. Spencer. The most remarkable thing about the whole discussion was the unanimity of opinion that obtained after the Conference had heard the Executive's new views on the subject. It so happened that while the Conference was in progress, the Minister of Broadcasting, Mr. F. W. Doidge, returning from Great Britain, issued a statement to the press indicating that he had entirely reversed his opinion, expressed publicly just before leaving New Zealand, that TV could not be started in this country for many years, on grounds of expense alone. It appeared that his new attitude towards TV coincided almost exactly with that of the Federation, which then and there dispatched a telegram to the Minister offering their congratulations on his progressive attitude. It was decided, too, that the incoming executive should be instructed to arrange as soon as possible for a meeting with the Minister in order to reaffirm their views, and to convince the Government of the desirability of their making an official policy pronouncement as early as possible.

WHAT ABOUT THIS MAGNETIC TAPE RECORDING?

PART 3

OBTAINING A FLAT FREQUENCY RESPONSE

The first two instalments of this article have described the basic phenomena of magnetic recording, and have given some idea of the construction of the heads, the mechanism used for moving the tape, and the frequency response of the tape itself We now go on to discuss the way in which a flat frequency response is obtained, and to indicate the differences between the three types of head used in a recorder.

In Fig. 7, reproduced here for convenience, is shown the shape of a typical response curve obtained from a specimen of tape. This curve is the one obtained when the recording head is fed with a constant current at all frequencies. From low frequencies upwards, it will be seen that the response rises almost linearly up to about 500 c/sec., after which the rate of rise decreases progressively. As a result, a peak is reached at some high frequency (in this case about 8000 c/sec.), and after this the response falls again, reaching a true zero at the frequency where the wavelength in the tape is equal to the width of the recording gap.

The curve illustrated in Fig. 7 actually illustrates a fairly high tape speed, in excess of 15 in./sec., but the *shape* of the curve is not affected by the tape speed. If the speed were halved, the frequency scale would be halved also. For example, the peak would come at 4000 c/sec. instead of 8000 c/sec. Since this curve can be said to represent the response of the tape itself, it is clear that if our complete system is to have the flat frequency response that we so much desire for most audio equipment, something will have to be done about it. The question is, what? If frequency response were the only thing to be considered, it would be necessary only to give the recording amplifier a response that was the inverse of Fig. 7. That is to say, the amplifier response would have to exhibit a minimum, after which it would rise in order to compensate for the high-frequency drop in the tape's response.

The curve for the amplifier would then be exactly the same as that of Fig. 7, except that it would be upside down.

Unfortunately, there is a very good reason why the tape response cannot be simply equalized in this way. It is the old bugbear of noise—magnetic noise, that was found so objectionable a feature of the old D.C. biased recording system. There are actually several sources of noise, and it is essential to do all in our power to eliminate them, particularly if the overall result is to be better than those of good disc recording. Another important fact that ties in with the above point is that at all frequencies the maximum level that it is possible to put on the tape without introducing distortion is not the same. In getting the best possible results, whatever the final frequency response is to be—wide or narrow—it is necessary to take both these things into account.

Now, with all recording systems, the best signal-to-noise ratio is obtained when the recordings are made at as high a level as possible without overloading the material. That is why the majority of disc records are made so that the loudest passages just do not cause the grooves to run into one another. There is no such limitation with magnetic tape, but, as with all systems, there is a limit to the level that can be recorded. With the tape, it is the level at which distortion becomes too great to be tolerated. As we have said above, this level varies with frequency, but luckily the variation is quite simple in character. At middle frequencies, the maximum level permissible is constant, but falls off at high and low frequencies.

Now a glance at Fig. 7 will show that at high and low frequencies, the response needs equalizing upwards, but if we carry this too far, we run into overload trouble, and the only way to overcome this is to reduce the overall recording level and use a level which allows the greatest permissible distortion to be reached at the ends of the desired frequency range. But if we do this, the middle frequencies will be recorded at considerably less

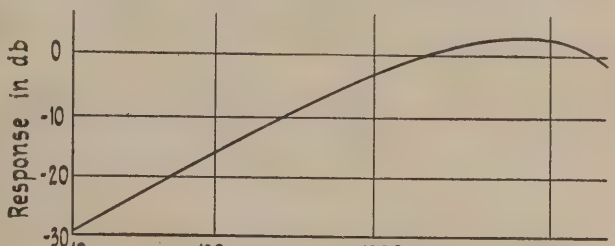


FIG. 7

level than the tape will accept, and the result is a signal-to-noise ratio that is not as good as it might be.

At this point, however, a very useful fact comes to the rescue. It is that *in music, the loudest sounds do not occur at all parts of the audio range.* Tests made on a number of orchestras have shown that the greatest sound level occurs at approximately 400 c/sec., and that at frequencies both lower and higher than this, the maximum level is reached considerably less than at this frequency. This is shown in Fig. 10, curve A. The practical informa-

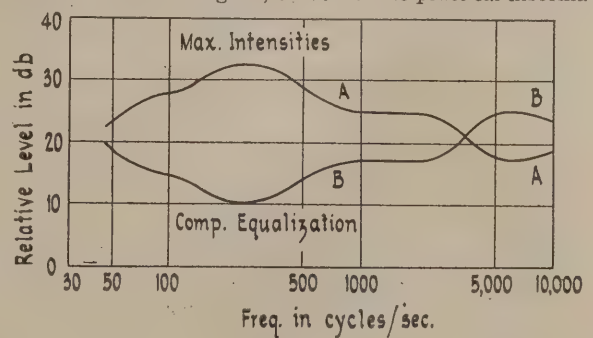


Fig. 10

tion imparted by this curve is that our whole system needs to be able to handle the maximum sound output of the microphone only at about 400 c/sec. At all other frequencies, the output would be less, so that, in a sense, the power handling capacity of the amplifier at these

frequencies is wasted. In practice, we do nothing about this, since it is much easier to make an amplifier whose power output is the same over the whole audio range and also because of other things which do not concern us here. But in tape recording, there is considerable advantage to be gained by using the tape to the limit of its capability. Thus, if we have an amplifier with a response characteristic like B in Fig. 10, and use this amplifier to record with, we will arrive at the situation where all frequencies will cause the tape to be fully loaded.

However, this still does not give us a flat overall response, and in practice the equalization for the maximum levels occurring in music has to be combined with that for the unequal response of the tape itself. If this is done, for a wire or tape whose response curve is as

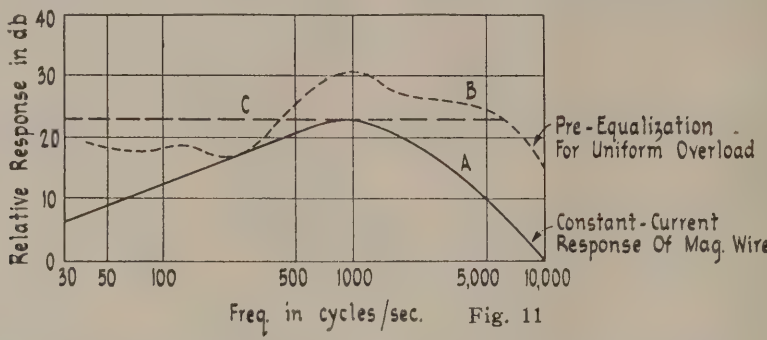


Fig. 11

at A in Fig. 11, we arrive at an overall equalization curve like B on the same figure. As can be seen, this is of a very awkard shape, and would be difficult to get in practice without quite complex circuitry. However, if it were used, we should have an overall response curve as at C, and would at the same time have the best possible signal-to-noise ratio that the tape could provide.

In some very high-quality recorders, this sort of frequency compensation is actually used. The recording amplifier is given a response curve similar to B of Fig. 10. This amounts to pre-emphasis of both low and high frequencies. The overall result of doing this can be gauged by drawing a new curve which is the difference between this one and the unequalized response curve of the tape—A in Fig. 11. The result is not shown on the diagrams, but amounts to a curve with a fairly level response between 100 and 400 c/sec., with a sharp rise from 400 to 1000 c/sec., and again almost a flat response from 1000 to 5000 c/sec. The frequencies mentioned refer to a system in which the tape is run at such a speed as to make a flat response up to 5000 c/sec. possible.

SIMPLIFIED EQUALIZATION

Most recorders use a considerably simpler system of equalization, mostly because the theoretically ideal way is rather difficult and costly to perform. However, very good results can be obtained with simple equalizers, and in some cases, where the fidelity requirements are not at all stringent, it is even possible to dispense with equalizers altogether. One simple system that is often used is to compensate for the high-frequency falling-off during recording by giving the recording amplifier a rising characteristic above the turning point on the response curve of the tape. Then, during playback, the low-frequency loss is compensated by giving the playback amplifier a rising characteristic below 500 c/sec.

A good rule to remember when dealing with tape is to limit the highest recorded frequency to the one at which the tape response curve is 10 db. below the peak.

Another idea that has been used is to equalize both high and low frequencies at the same time, but to apply only half the equalization during recording and the other half during playback. The usefulness of this is that the recording and playback amplifiers need the same response curve, so that only one amplifier is needed, as it can be used for both purposes. Nevertheless, most commercial recorders use separate amplifiers for the two purposes, each with its own response curve.

On account of the difficulty of entirely eliminating hum from the playback head of the tape recorder, it is common practice to equalize for the low-frequency response in the recording amplifier, and for the highs during playback. This gives a lower hum-level than the other way about, because the recording head is not nearly so subject to hum as is the playback head.

RECORDING, PLAYBACK, AND ERASING HEADS

In our earlier discussion of the fundamentals, no mention was made of the actual differences to be found between magnetic heads used for the three purposes. Practical heads do differ considerably, however, according to the use to which they are to be put.

RECORDING HEADS

There are several requirements which a satisfactory recording head must meet. In the first place, the recording field produced by it must be sharply defined, and the gap must be very narrow. One reason for this has already been stated—namely, that with large gaps the frequency response reaches its peak at quite low frequencies unless a high tape speed is used. Another important reason is that if the field is diffuse (that is, tails off gradually on either side of the gap instead of decaying very rapidly), there is a large self-demagnetizing effect, which limits the degree of magnetization of the tape.

In order that the field which represents the output of the head shall be an accurate and undistorted reproduction of the exciting currents passed through the coils, the material of which the head is made must have low eddy-current and hysteresis losses. Eddy-current losses can be made small in the same way as for transformers—that is, by using a core made up of fine lamination instead of a solid block of material. If eddy-current losses are high, they will vary with frequency, and will therefore make it necessary to apply frequency compensation to the head itself.

Materials such as mu-metal and the permalloys have very narrow B-H loops, and therefore small hysteresis losses, and these are always used in recording heads.

Another important property of the head is its impedance This will depend on the number of turns of wire on its coils, and the impedance that may be desirable in a particular application will depend on the type of valve used to feed the head, and on whether or not a matching transformer is to be used with it. It is a distinct

advantage to keep the impedance of the head low, because this means a winding of fewer turns, and therefore of smaller distributed capacity. Whatever the impedance, the head will have some frequency at which its inductance resonates with the distributed capacity, and for a recording head it is necessary to keep this resonant frequency higher than the supersonic bias frequency. It is much easier to do this if a low-impedance head is used, fed by a transformer, but this adds to the expense. If the self-resonant frequency is lower than the bias frequency, there will be difficulty in realizing a high enough bias field, because the bias frequency will be partially bypassed to earth by the distributed capacity of the head.

Mechanically, the head must be designed so as to make a good, uniform contact with the tape, and must also be convenient to use. Some heads used earlier necessitated passing the wire or tape through holes in the pole-pieces, and caused threading difficulties. Modern heads, though, are almost all of the general kind illustrated in Fig. 1. This is known as the "ring" type of head, and, indeed, the core usually is circular in plan form, and not rectangular, as shown in this diagram.

REPRODUCING OR PLAYBACK HEADS

Some of the requirements of the playback head are very similar to those of the recording head. If this were not so, it would not be possible to have combination heads, in which the same head is used for both operations. However, in the better-class instruments, separate playback heads are used. The first essential for this head is that it should have as small a gap as possible. It should be no wider than that of the recording head, and, preferably, it should be narrower.

Like the recording head, it should have as small losses of both kinds as possible, this time because it has to handle extremely weak fields, and high losses will degrade the output level and also the signal-to-noise ratio of the system.

The playback head must be as well shielded against external magnetic fields as possible, and should be as small, physically, as possible. In addition, some type of

Outstanding in Performance

GARRARD

MODEL R.C. 70A

AUTOMATIC RECORD CHANGER

The Garrard Model R.C. 70A Record Changer will automatically play any number of records up to a maximum of ten 10 in. or ten 12 in. not mixed. The Model R.C. 70A is supplied complete with all fixing screws and patented suspension springs ready for fitting into cabinet. Cabinet space required for fitting is 15½ in. long by 13½ in. wide with 5½ in. clearance above, and 2½ in. clearance below top of motor board.

FEATURES

- The turntable and mechanism are driven by the New Garrard Drum-drive Motor, which maintains a constant speed of 78 f.p.m. with ample torque.
- Automatically switches off and stops when last record has played.
- Fitted with the new Garrard Plug-in Pick-up Head. (Provisional Patent 4391/49.)
- Any record can be rejected whilst playing by moving knob to "reject" position.
- All operating knobs are clear of the pick-up head.
- Time of operation from finish of one record to commencement of next is four seconds.
- No electrical interference with radio reception when motor is running.
- Pick-up arm lifts to change needles.
- Specially designed, patented spring suspension eliminates mechanical resonance between pick-up and loudspeaker.

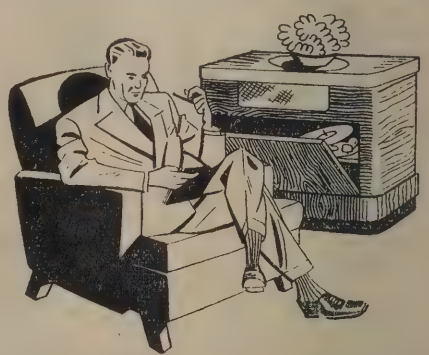
The Garrard Model R.C. 70A Record Changer is supplied in the following types:—

R.C. 70A/A.C.—A.C. only. Dual voltage range, 100/130 and 200/250 volts 50 cycles. A motor pulley for 40 or 60 cycles can be supplied if required.

R.C. 70A/6V.—D.C. only; 6 volts. Current consumption 2 amps.

R.C. 70A/12V.—D.C. only; 12 volts. Current consumption 1 amp.

R.C. 70A/D.C.—D.C. only. Dual voltage range 100/130 and 200/250 volts.



GARRARD
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construction should be used which gives it a low sensitivity towards external fields.

One of the major practical difficulties of tape recording is that of hum picked up during reproduction. This is because the field from the tape, and on which the playback head has to work, is so small that hum pick-up must be extremely low if it is not to cause trouble.

Recording and erasing heads need hardly any shielding, because they are working with much stronger fields, which completely over-ride hum or other stray fields. Playback heads, however, must be shielded with high-permeability magnetic material, and must be of humbucking construction. The latter is effected by introducing the second gap, immediately behind the recording gap. This, in conjunction with the proper form of winding, ensures that the coils are in series aiding, in so far as input to one gap is concerned, and in series opposing with respect to input which affects both gaps. Although not a function of the head itself, its positioning in relation to the hum-producing parts of the recorder is important.

It is desirable to have as many turns on the playback head's coils as possible, because the voltage output is proportional to the number of turns. On the other hand, the resonant frequency of the head must be higher than the highest frequency to be reproduced, since, if it is not, grave irregularities will be introduced into the frequency response at the high-frequency end. It is really preferable to use a low-impedance head and a step-up transformer to the grid of the first amplifier valve, although this makes one more low-level component to shield, and adds expense.

In considering the question of hum pick-up, the overall size of the playback head is also important. This is because the amount of output due to hum is proportional to the number of lines of force linked with the core. For a given hum field, this is obviously proportional to the area of the head, so that a small head, otherwise identical with a large one, will have lower hum pick-up. This is one of the best reasons for using a very low-impedance playback head, because if only about 50 turns are used on the coil, the head can be made very small indeed. Any transformer that may be used must itself be very well shielded indeed, and located as far as possible from sources of hum. However, it is usually easier to do this than to locate the head itself in a spot where the hum is very low, because there is no restriction, practically speaking, on the positioning of a small transformer, while the head must of necessity be fairly close to at least one motor.

The pole pieces of playback heads must be made of material which has a very low value of remanence. If this is not so, it will be possible for the head to acquire a small degree of permanent magnetization. This is ruinous to the signal-to-noise ratio of the system, because it has been found that with modern types, whose coating is finely powdered iron oxide, even a very minute D.C. magnetization of the playback head causes a large increase in noise level. For instance, it is essential *never* to allow any direct current to flow through the windings of a playback head. Even testing for resistance or continuity with an ohm-meter will completely ruin the performance of the head until it is properly demagnetized once more.

ERASING HEADS

Of the three types, erasing heads have perhaps the least difficulty associated with their design. The gap is purposely made large in order that demagnetization may be effected properly.

The principle of the A.C. erasing head almost univer-

(Concluded on Page 48.)

TUBE DATA: RIG-BUILDER'S CIRCUIT GUIDE

Editor's Note

[We are indebted to the Amalgamated Wireless Valve Pty. Ltd. for the accompanying data, which should be of considerable assistance to all those concerned with transmitting equipment. This month, on the next two pages we present the first two of the circuits, complete with their appropriate charts. Others will be presented next month.]

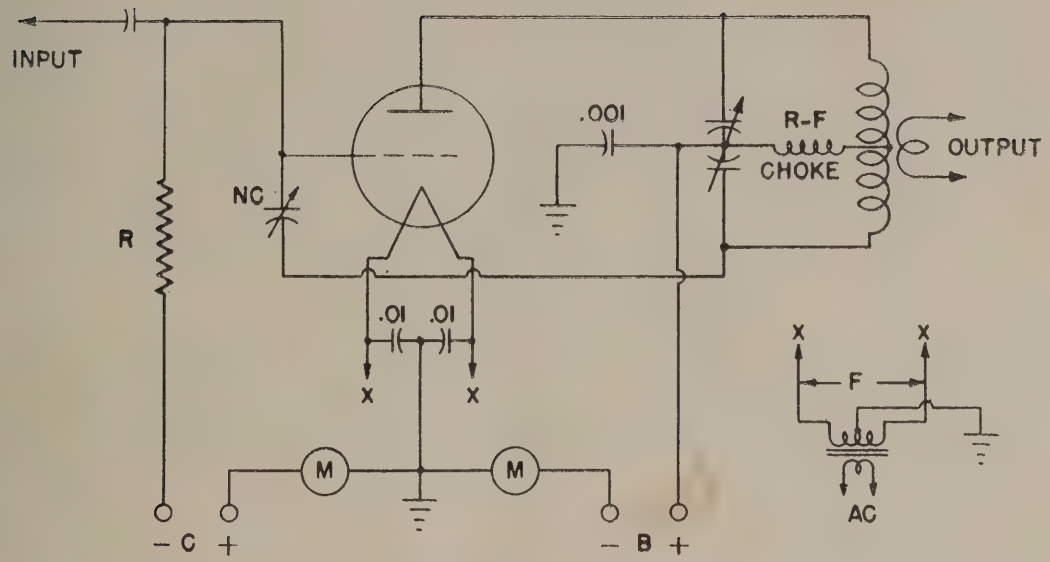
Recognizing that most R.F. and audio circuits change very little from tube to tube, this issue presents six standard circuits. With each circuit are listed the types of tubes which will operate in that circuit, together with the circuit constants which must vary from tube to tube. These six standard circuits are therefore the equivalent of 89 separate circuits.

The single-tube circuits (circuits A and B) may be employed as either buffer or final circuits. An untuned grid circuit is shown in order to keep the diagram as simple as possible. Circuits C and D are push-pull circuits, and would normally be used as circuits for final amplifiers, although low-power tubes in these circuits will allow their use as buffer amplifiers. Circuit E is a class B audio modulator circuit, and circuit F is a class AB_2 modulator circuit.

The tube operating conditions given in the tables are, in most cases, the conditions for maximum input. It is important that these limits are not exceeded. The bias voltage given in circuits A, B, C, and D is designed to protect the tubes in case of excitation failure, or in case the crystal or VFO circuit is keyed. In the case of these four circuits, bias is obtained by a combination of grid resistance bias and fixed bias. These values may be changed if desired. For example, the grid resistor can be omitted if the fixed bias is increased. This increase in fixed bias should be equal to the amount of bias that was obtained from the grid resistor due to the grid current (Ig). Conversely, the fixed bias can be removed and the grid resistor increased to give the proper bias. This is not recommended unless the stage is protected by an overload relay in the plate circuit.

Values for grid and plate coils and condensers are not specified. Manufactured assemblies may be used or home-made coils employed. The table gives the air-gap necessary for the plate condenser. In the case of split-stator condensers, the air-gap given is still valid for each section. This value of spacing allows a 100 per cent. factor of safety.

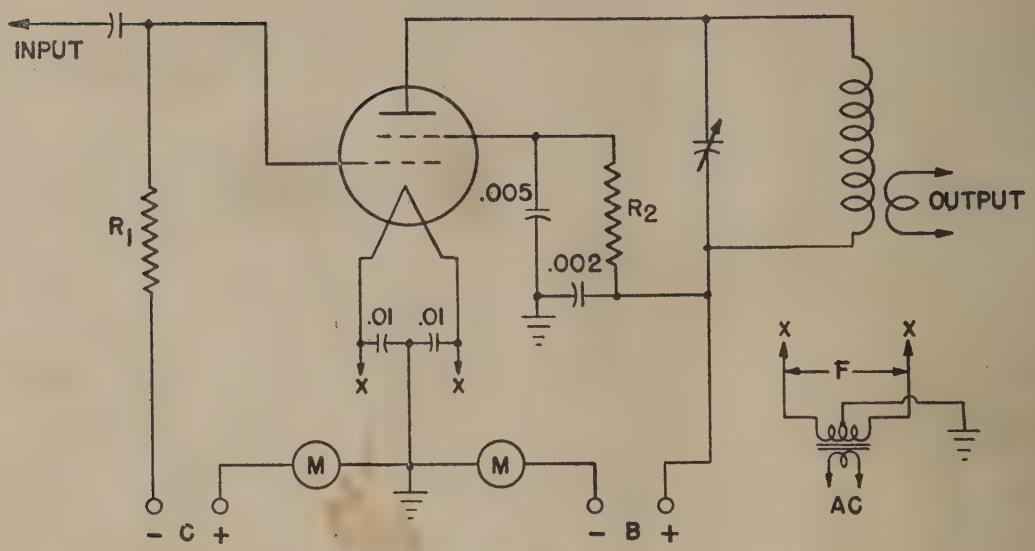
TRIODE
BUFFER OR FINAL



CIRCUIT A

Tube Type	Input Watts		B		C		I_g ma		R ohms	F volts	Airgap (inches)	
	CW	PH	CW	PH	CW	PH	CW	PH			CW	PH
35T	250	168	2000	2000	45	105	45	23	2,000	5.0	.100	.250
100TH	495	366	3000	3000	75	215	51	26	2,500	5.0	.200	.500
203A	188	150	1250	1000	80	45	25	50	1,800	10.0	.070	.100
211	188	150	1250	1000	135	90	18	35	5,000	10.0	.070	.100
592	600	395	2600	2500	90	200	45	45	3,500	10.0	.175	.375
805	300	200	1500	1250	45	70	40	60	1,500	10.0	.078	.144
806	990	585	3300	3000	250	440	40	27	8,750	5.0	.250	.500
810	620	450	2250	1800	45	45	40	50	3,000	10.0	.150	.225
811	225	156	1500	1250	45	25	35	50	2,000	6.3	.078	.144
812	225	156	1500	1250	95	46	25	25	3,200	6.3	.078	.144
838	188	150	1250	1000	45	45	30	60	1,500	10.0	.070	.100
1623	100	75	1000	750	45	75	20	20	2,500	6.3	.070	.084
8000	750	500	2500	2000	135	275	40	37	2,500	10.0	.175	.250
8005	300	238	1500	1250	90	160	32	28	1,250	10.0	.078	.144

TETRODE, PENTODE & BEAM POWER BUFFER OR FINAL



CIRCUIT B

Tube Type	Input watts		B		C		I_c ma		R_1 ohms	R_2 ohms PH*	E_{sg} volts		Airgap (inches)	
	CW	PH	CW	PH	CW	PH	CW	PH			CW	PH	CW	PH
2E24	40	27	600	500	20	15	3	3	10,000	40,000	195	180	.050	.070
2E26	40	27	600	500	15	20	3	3	10,000	35,000	185	180	.050	.070
4D21	500	375	3000	2500	90	150	9	9	7,000	71,500	350	350	.200	.375
802**	33	20	600	500	45	0	2	2	27,000	17,000	250	245	.050	.070
803†	320	240	2000	1600	45	0	12	20	37,500	20,000	500	500	.100	.200
807	75	60	750	600	20	60	4	4	7,000	50,000	250	275	.050	.070
813	360	240	2000	1600	45	70	3	4	15,000	60,000	400	400	.100	.200
814	225	180	1500	1250	45	60	10	10	4,500	43,000	300	300	.078	.144
828‡	270	200	1500	1250	45	85	12	12	4,500	30,000	400	400	.078	.144
837**	30	18	500	400	45	0	4	5	7,500	13,000	200	140	.050	.050
1613	18	12	350	275	0	0	4	4	10,000	7,500	200	200	.030	.030
1614	30	23	375	325	0	0	2	2	20,000	10,000	250	245	.030	.030
1619	30	20	400	325	0	20	5	3	11,000	5,000	300	285	.030	.030
1624	54	38	600	500	45	45	5	3	3,000	25,000	300	275	.050	.070
1625	75	60	750	600	20	60	4	4	7,000	50,000	250	275	.050	.070

*Phone only; see text. **Suppressor grid voltage = +40 volts.
†Suppressor voltage of +40 for CW and +100 for phone.
‡Suppressor voltage = +75 volts.

SIMPLE METHODS OF MEASURING RESISTANCE

By the Engineering Department, Aerovox Corporation

Radio servicemen and experimenters frequently have occasion to measure the resistance of circuits or component parts. An instrument for this purpose should be simple, rapid in operation, have a wide range, be reasonably accurate, and, above all, it should be inexpensive. The equipment generally used meets these requirements fairly well. There is, however, a lack of understanding of the principles of operation as well as the cause of errors and how they can be avoided. The specification of the range of the instrument is usually vague and often meaningless. It is hoped to clear up many a mysterious point in the following article. It will also be shown how any voltmeter or milliammeter can be pressed into service to measure resistance. A chart is given which serves to find the required resistance from the meter reading; this chart will be valid for any kind of meter and for two different types of circuits.

THE "SERIES" CIRCUIT

The simplest type of circuit used for the measurement of resistance is shown in Fig. 1. It consists of a milliammeter, a resistance and a battery. In commercial instruments and in most other cases, the resistor has been given a value which is just right for making the milliammeter show full scale reading. This is done to get the greatest possible spreading of the resistance scale but it

Fig. 1

should be understood that it is not essential because the circuit can be used for resistance checking if the meter does not show full scale when the terminals X-X are shorted.

The procedure is as follows: the terminals X-X are shorted and the meter reading noted; let us call this reading m. The unknown resistance is connected between the terminals X-X and the reading is now n. The value of the unknown resistance is:

$$R = \frac{m - n}{n} Rs$$

Note that in the above reasoning there was no mention of the range of the milliammeter; and from the above paragraphs it should be clear that any meter, milliammeter or voltmeter can be used. The difference will be in the values of resistance it will measure most accurately, but any meter can be used and by the proper selector of the resistor Rs and the voltage of the battery, different resistance ranges can be obtained.

RESISTANCE SCALES

Special scales for the resistance ranges are made available by meter manufacturers. These scales are all made with the understanding that the reading m is full scale reading. They are made for various values of Rs, which really should be the value of the complete circuit including the resistance of the meter and of the battery. Now it can be shown mathematically, that the scales all resemble each other and the only difference between two scales, one of which is designed for a circuit having 1500 ohms resistance and one having 3000 ohms resistance, is that all values on the resistance scale of the second instrument are twice the corresponding values of the first.

Another peculiarity of the scale is that the value of the resistor Rs (in Fig. 1) plus the meter resistance, always appears at half scale reading. When ordering such a scale one orders by "centre scale reading" and not by a range of from 1–100,000 ohms or any similar designation. Standard scales generally have centre scale readings of 1500, 3000, or 4500 ohms, or multiples of these values. This is done because of the prevalent use of 0–1 ma. meters and standard batteries of 1.5 volt each.

WHAT IS THE RANGE OF THE INSTRUMENT?

Theoretically, any instrument of the kind illustrated in Fig. 1 has a range from zero to infinity. On both ends of the scale, however, it becomes impossible to obtain accurate readings. The greatest accuracy is to be had at the middle of the scale and it becomes less and less when approaching either end. The range of the meter should therefore be given by specifying the reading at half scale deflection and allowing a ratio of 1 to 10 or 1 to 20 either way. For instance, a resistance checker which has a centre scale reading of 1500 ohms, can be used accurately for measuring values between 150 and 15,000 ohms. Beyond these limits errors become large. Some prefer to give the range of this instrument as from 75 to 30,000 ohms, thus allowing a ratio of 1 to 20 either way

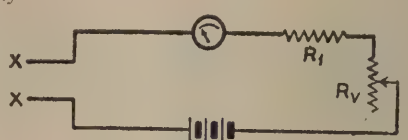


Fig. 2

THE "ZERO ADJUSTER"

Compensating for variations in battery voltage is the cause of serious errors unless it is done properly. Fig. 2 shows the easiest way of doing it. A variable resistor, Rv is used in series with the resistor R_1, the sum of the two being somewhat more than Rs in Fig. 1. If the voltage of the battery drops, the variable resistor is adjusted until full scale reading is again obtained. In doing so, the all-important "circuit resistance" has been changed and in order to be accurate, the scale should have this new resistance value at centre scale reading. The result is that all measurements will be off by the same percentage. If the battery voltage has dropped 10 per cent., the instrument will show all resistance values 10 per cent. too high.

These errors can be made negligible when the zero adjuster is connected across the meter instead of in series with it. A suitable circuit is shown in Fig. 3. Instead of choosing the value of R_1 so as to permit the meter to read full scale, the resistor is made smaller, so that approximately 20 per cent. more current flows than the meter can indicate. This extra current is passed around the meter through the variable shunt, R_2. It is adjusted for full scale reading before testing resistors.

GETTING MULTIPLE RANGES

The above resistance check would be accurate only from 450 to 45,000 ohms and no doubt readers wish to extend that range both up and down. (It should be

understood that the usual calibrated dial is calibrated somewhat beyond these limits, but the range becomes too crowded to be accurate.) The range can be extended upwards by adding resistance to R_1 and to add a corresponding amount to the battery. For instance, by adding 9 times 4,500 ohms (40,500 ohms) in series with R_1 and adding nine times 6 volts (54 volts) to the battery, all values of the scale are multiplied by ten. The instrument now reads from 4,500 to 450,000 ohms. Similarly, by shunting (connecting between A and B in Fig. 3) the whole circuit with a resistance of 500 ohms (1/9 of 4500) the range becomes lower and all meter readings should be divided by 10. The same process can be repeated.

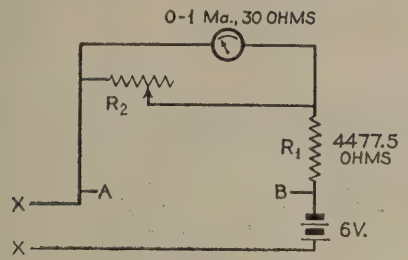


Fig. 3

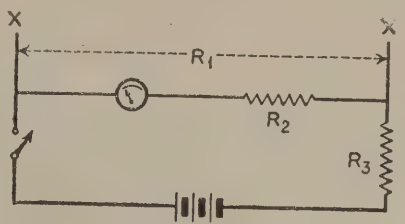


Fig. 4

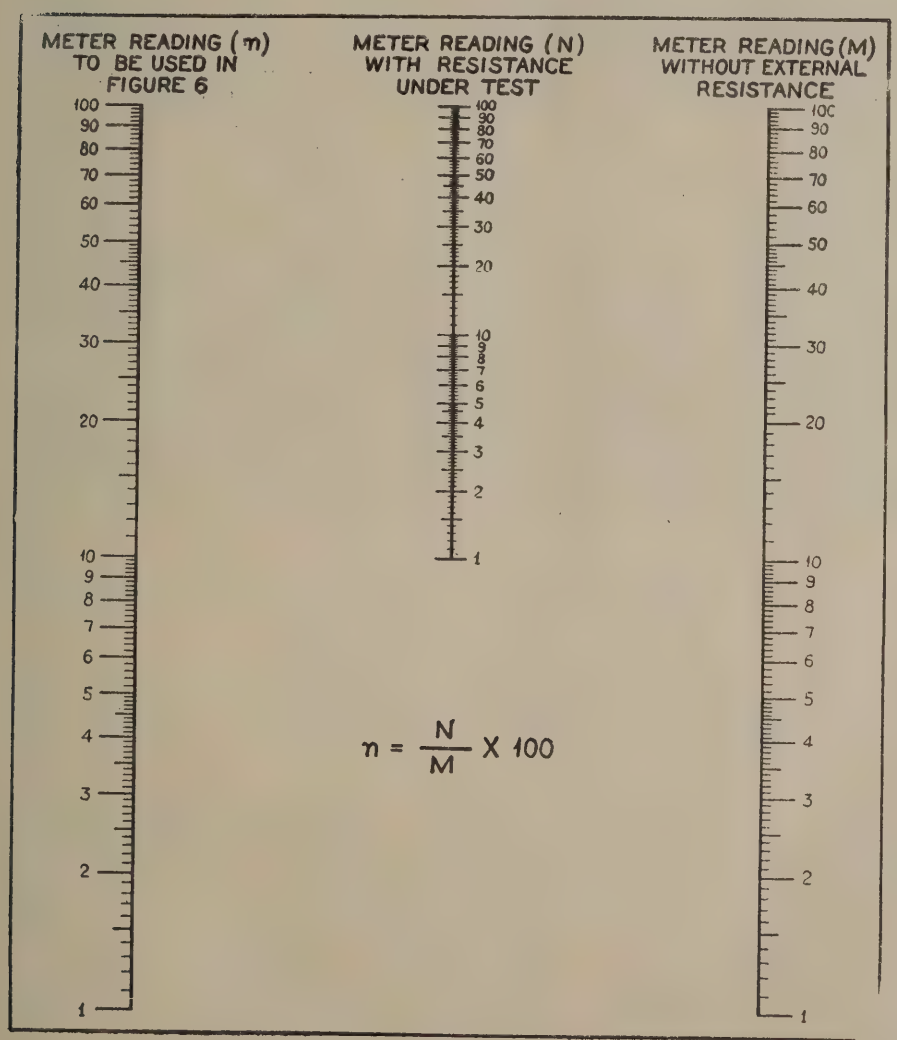


Fig. 5

THE SHUNT CIRCUIT

A second circuit, often used in radio work is shown in Fig. 4. Here, the meter is placed in series with an adjustable resistor and the unknown circuit is connected across the meter or across the meter and a small resistor R_2. The circuit under measurement then acts as a shunt on the meter and the needle will fall back depending on the size of the shunt. If we again call the first reading m (without the shunt) and the reading with the unknown resistor as a shunt n, the value of the unknown resistor is given by

$$R = \frac{n}{m - n} R_1$$

where R_1 is the sum of the meter resistance plus the series resistor R_2, if any. The equation greatly resembles that for the series circuit. When two scales are made up, one according to each equation and both having the same centre scale reading, they will be mirror views of each other.

The circuit is usually employed for low ranges, because the meter resistance is generally low. Placing a 30 ohms 0–1 ma meter in series with 4500 ohms and a 4.5 volt battery, would give a range of 1/20th of 30 to 20 times 30 or from 1.5 to 600 ohms.

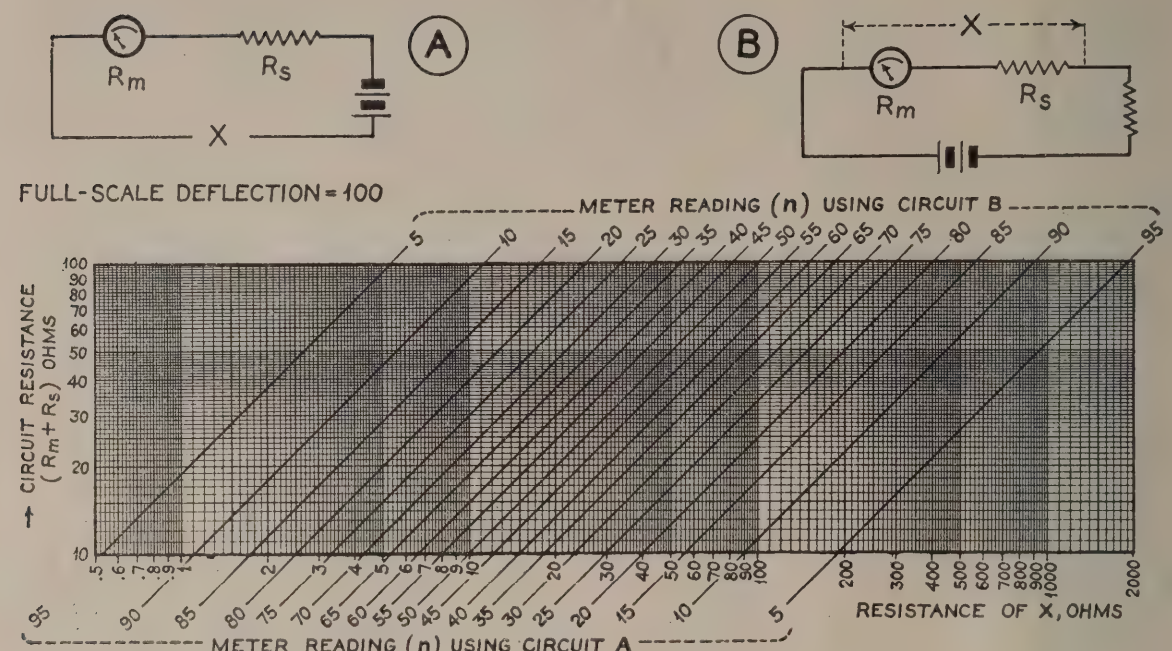


Fig. 6

The equation given above will not be valid unless the series resistor R_s is larged compared to R_1, or centre scale reading. Therefore, in the above example, 4500 ohms and 4.5 volts were chosen rather than 1500 ohms and 1.5 volt.

As a zero adjuster, R_s can be made variable or rather a part of it should be variable. The example quoted could employ a fixed 4000 ohm resistor and a 1000 ohm variable one in series with it.

USING ANY METER AS RESISTANCE METER

The foregoing is sufficient introduction to the use of any meter as resistance checker, if no calibrated meter is handy. The instructions are: place the instrument in series with a battery and sufficient resistance to make it indicate full scale or nearly full scale, when the circuit is closed, employing the circuit of Fig. 1. If the meter in question is a voltmeter, the multiplier will serve as the resistor Rs in Fig. 1 and the instrument has to be connected in series with a battery within its measuring range. The unknown resistance can be found by calculation. A similar procedure can be followed with the parallel circuit of Fig. 4.

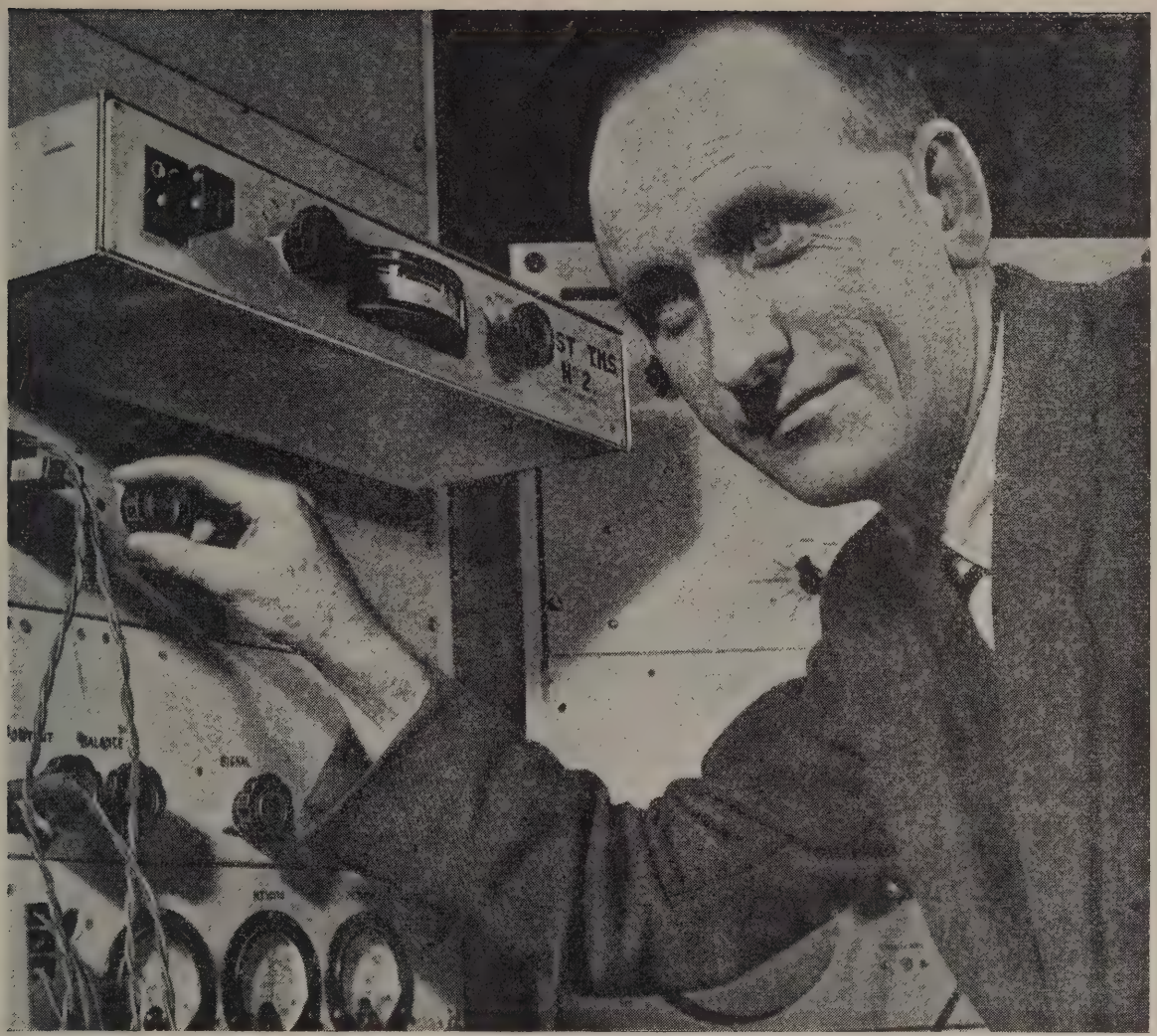
USE OF THE CHARTS

Figs. 5 and 6 are charts designed to eliminate all calculations for those who do not have their resistance meter calibrated. Fig. 6 is to be used for any resistance checker which shows full scale reading before the unknown resistor is connected. It is used as follows: Assuming that the circuit resistance is known, check the unknown resistance and get the reading n on the meter. Along the vertical scale of Fig. 6, find the value of the circuit resistance (Rm + Rs), follow the horizontal line to the right until it intersects the slanting line representing the meter reading. Moving downward at this crossing, read the value of the resitsance on the horizontal scale below. When the circuit of A (Fig. 6) is used, the meter reading should be entered from the bottom of the chart. The circuit, B, of Fig. 6 requires the use of the scale along the top of the chart for the meter deflection.

The graph is direct reading for values of Rm + Rs of from 10 to 100 ohms; for values beyond these limits, all values along the vertical and horizontal scales should be multiplied by the same number, 10, 100, etc.

Fig. 5 is designed for those who are using a meter, battery and resistance in any emergency and may not have the meter show full scale deflection when X-X is shorted in circuit A or open in circuit B. Find the meter reading M without the unknown resistor, and the reading N with the resistor in the circuit. Lay a straight edge along the corresponding values N on the middle scale and M on the left hand scale of Fig. 5. The intersection with the left hand scale shows the value n to be used in Fig. 6.

If the circuit resistance is not known, it may be found by measuring a standard resistor and working the problem backwards, entering Fig. 6 with this value on the horizontal scale and finding Rm + Rs on the vertical scale.



The measurement of operating frequencies of carrier oscillators.

From First Principles to Finished Product

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A.1281-T611

Report on the Annual Conference of the N.Z. Radio and Television Manufacturers' Federation

The 1950 Annual Conference of the New Zealand Radio Manufacturers' Federation was officially opened at Chateau Tongariro on Monday, 30th October by the President, Mr. William J. Blackwell, who welcomed all members attending the Conference, and others who were the guests of the Federation at the Conference. A special welcome was extended to Mr. B. Bookman, who attended the Conference in order to make recommendations on advertising matters, and to Messrs. W. D. Foster and C. H. Roser, of this journal. Replying to Mr. Blackwell's remarks, Mr. Foster indicated his pleasure at being present at what promised to be a very important function to the radio industry and all connected with it, and thanked the President for his complimentary remarks about Radio and Electronics.

Apologies were received from the Director of Broadcasting, Mr. William Yates, and from Mr. T. R. Clarkson, of the Post and Telegraph Department, both of whom were prevented by official duties from attending. Apologies were also received from Messrs. S. C. Shea, Telecommunications Limited, L. A. Chaston, and E. J. Palmer, Inductance Specialists.

PRESIDENTIAL ADDRESS

The next item on the agenda was the address by the President, Mr. W. J. Blackwell. In his address, Mr. Blackwell outlined the Executive's activities during the past year, giving the Conference a résumé of the action taken with regard to a number of important problems, and detailing the success or otherwise which had attended the Executive's business.

The past year had been a notable one for the radio industry, Mr. Blackwell said, since it was during that period that the Executive's efforts to have the industry de-controlled had been crowned with success. The radio industry had been the first major industry to be decontrolled, and had subsequently shown that the confidence placed in it by the Government had been well-founded. The removal of control had actually resulted in a drop in prices paid by the consumer, he said, and the industry had completely vindicated the claims made on its behalf when the matter was under consideration.

In spite of the removal of price control, Mr. Blackwell went on, many Government controls were still operative. The Government believes in free enterprise, but is either reluctant, or finds it very difficult to ease the many controls that still exist. It was therefore the part of the Federation to stress every important point, and to keep on doing so in the attempt to have these restrictions lifted. The most important problem in this class was the question of import licences, which were still no easier to operate than under the previous administration.

In spite of the difficulties that exist, Mr. Blackwell went on, the industry stands at present on the threshold of the greatest opportunity it is ever likely to have, namely television. The Executive had given a great deal of thought to television, and had decided that the time was past when opposition to its coming can be of any use to anyone. The previous decision of the Federation to oppose all publicity about television because much of what had been written in the public press had been ill-informed and harmful to the industry, had had to be reviewed in the light of later knowledge, which indicated, among other things, that the only way of making the public believe that television does not outmode the ordinary radio set is to give it television, and let the people find out by experience of what no amount of telling seems to convince them.

Passing from television, the President reviewed the work done by the Federation's Patents Committee, and congratulated them on the excellent and painstaking work that had been done by them in preparing a case to go before the Patents Commission. The commission's findings had reported in a manner that was extremely favourable to the Federation's submissions, and the industry stood to gain a great deal when the commission's recommendations were made the subject of suitable legislation.

Mr. P. C. Collier, Vice-President of the Federation, had made a full investigation into the interference problems that beset the industry, and had produced a report which had been presented to the appropriate authorities.

Among the other matters mentioned by Mr. Blackwell was that of sales tax. No success had as yet attended the Federation's efforts to have sales tax on radio sets remitted. It was a very difficult problem, which was continually under review by the Executive, which would continue its efforts in this direction, and the hope was expressed that a satisfactory outcome might yet be achieved.

Another matter which had given the Executive much concern was the arbitrary attitude of the Customs and Industries and Commerce Departments in making far-reaching decisions on certain imported components without prior consultation with the Executive.

In conclusion, Mr. Blackwell said that he hoped that the growing interest by individual members in the affairs of the Federation would be a portent of even more successful operations of Federation business than during the past year, when it could be claimed that much had been accomplished.

Immediately following the President's address, routine matters of business, such as the presentation of the annual accounts, were discussed, before the Conference proceeded to the most important part of the agenda, namely, the items dealing with matters affecting the industry as a whole, and in which the Executive had been active during the past year. A very large volume of business was transacted; so much, in fact, that it would not be possible to recount even a portion of it in detail. We are compelled, therefore, to limit ourselves to a short precis of what are perhaps the most important items.

IMPORT MATTERS

A matter which had been viewed with considerable alarm by the radio industry as a whole was that of the arbitrary cut of 25 per cent. which had taken place in the licences granted for the importation of radio parts for the forthcoming (1951) licensing period. Very strong exception was taken to the fact that the cut, being of a "blanket" nature, had been imposed without any form of consultation with the industry, either through the Federation, or by any other means. Accordingly, a case had been submitted to the Import Advisory Committee,

requesting that the 25 per cent. cut be restored, and that the Federation be furnished with the reasons underlying the original decision to make the cut.

The main points submitted to the Import Advisory Committee for consideration were:—

(1) The radio industry is annually increasing its scope, and is growing through the addition of smaller units to its ranks.
(2) The annual production figures of the industry show a constantly rising trend in domestic radio sets alone, and to this must be added the increasing volume of business being done in electronic equipment other than radio sets, which nevertheless uses substantially the same materials and components as do normal broadcast sets.
(3) At present, the industry is faced with increasing prices for imported components, and overseas manufacturers have already given warnings of still further price increases, which will occur within the next six months or so.
(4) Orders from overseas are taking longer to reach New Zealand, and increasing delays are apparent in deliveries from the ports to the factories.
(5) Over the last two or three years, radio factories generally have tended towards a reduction in their reserve stocks because of improvements that have taken place in deliveries from overseas. Unfortunately, the situation is again deteriorating, and in consequence, existing holdings of raw materials and components are rapidly becoming inadequate.
(6) With the present unsettled state of international affairs, the radio industry considers it highly desirable to maintain imports not only at an economic level for present-day requirements, but also, if possible, at a higher level than normal, as a protection in the event of further deterioration in supply availability.
(7) The industry can no longer rely on war surplus stocks as these have now been completely consumed.

The presentation of the above case had not met with success, and the meeting resolved that the incoming executive should pursue the matter further in an attempt to obtain practical recognition of the Federation's views.

IMPORTATION OF CAR RADIOS

A case had already been presented in respect to the importation of car sets as part of the equipment of new cars, many of which had been coming in equipped with sets. It was decided to re-submit the case, although it was realized that cars imported privately could not be controlled in this respect.

PATENTS MATTERS

The Federation's Patents Sub-committee, consisting of Mr. P. C. Collier and Mr. J. Gifford, had done a great deal of work in preparing and submitting evidence before the Patents Commission, the President stated, and the meeting expressed its gratitude to these gentlemen for the excellent work that had been done, and which had resulted in the Commission's bringing down a report that was very favourable to the interests of the radio industry. It was noteworthy that although the report

(Continued on Page 26.)

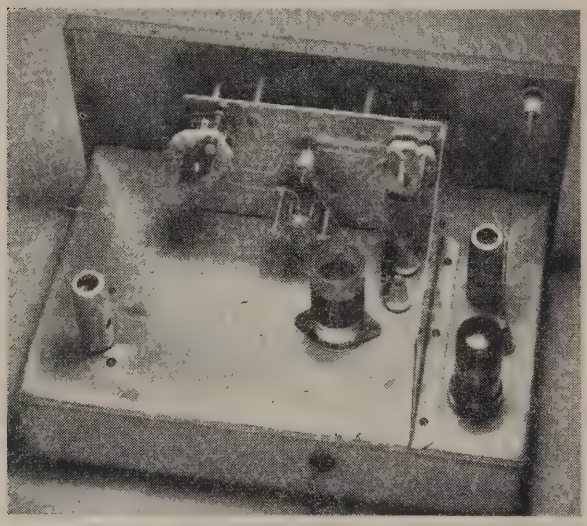
The PHILIPS Experimenter

No. 38: An Accurate Beat Frequency Meter for the H.F. Amateur Bands

PART II

CIRCUIT DETAILS (Continued)

The output of the variable oscillator is capacity-coupled to the injection grid of the ECH21. This valve has zero grid bias, and a large resistor (100k.) in the plate circuit as an A.F. load. Because of the high plate resistor, the plate current is not excessive, even with zero bias, which is used because it results in greatly increased output on the higher harmonics. The aerial is

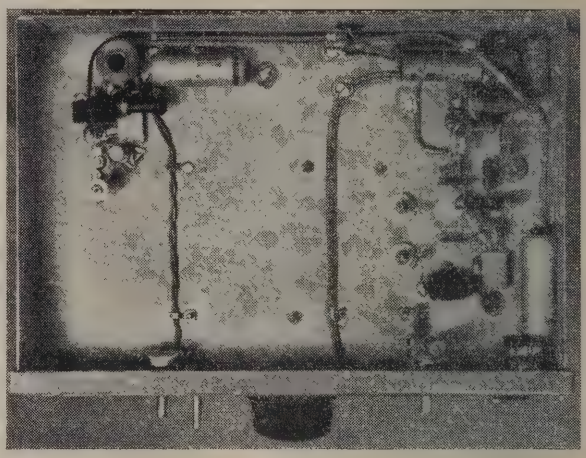


Above-chassis view of the meter. Note the ample room provided.

connected to the signal grid of the ECH21. This gives a physical separation between the aerial and the oscillator, which is most important from the point of view of stability, although the Clapp circuit is particularly non-critical in respect to loading when a pentode is used. It has the added advantage of giving more amplification to the aerial signal and increasing the overall sensitivity.

The crystal oscillator is a straightforward pentode Pierce circuit, with the output coupled via a very small condenser to a tap on the grid leak of the mixer valve. In this way, the two oscillators are isolated from each other, and there is no tendency for the variable oscillator to lock on to the crystal oscillator and prevent the observation of the zero beat. The H.T. switch to the crystal oscillator is mounted on the front panel, because this is not wanted when measurements are being made. In fact, the crystal is used only when setting up the variable oscillator immediately prior to making a measurement.

The ECH21 is very useful in special circuits like this one, because of the complete independence of the triode section from the heptode. Thus, it is possible to use the triode as an audio amplifier with grid-leak bias, and this has been done. A volume control is provided, for, although the couplings between the oscillators, the aerial, and the mixer valve have been carefully chosen so as to reduce somewhat the amplitude of the low-frequency input at the expense of the high-frequency components, it is still desirable to have a volume control for the sake of comfort if for no other reason. The level can be turned up when near zero beat so that the correct setting is easier to find, and turned down when far from zero beat, so as to prevent the operator's eardrums from being split by piercing whistles.



Under-chassis view, showing the shielded wiring from the crystal oscillator to the mixer valve, and from the audio circuit to the gain control.

MECHANICAL CONSTRUCTION

The two photographs printed with this instalment give a very good idea of the type of construction used in the actual instrument. The chassis was purposely made very roomy so that there would be no overcrowding of parts, and so that the two oscillators could be well spaced, the one from the other. The large chassis also makes it possible to space the operating controls adequately, improving the appearance, and allowing a large dial to be used to control the variable oscillator. The chassis is 8 in. x 12 in. x 2¼ in., and has the front panel, measuring 12½ in x 7 in. spot welded to its front face. This makes the chassis and panel together a single rigid unit, which is made even more rigid by the stout aluminium bracket which supports the main parts ,and which is braced to the panel by brass distance-pieces. The main part of the aluminium bracket measures 6¼ in. long, by 3¾ in. high. Along the bottom edge is a ½ in. wide flange, bent towards the panel, and used to mount the bracket to the chassis by means of three nuts and bolts. There is another flange at the right-hand edge,

this being used as a support for the baffle-shield which runs at right-angles to the panel. This shield is there for two reasons—to add rigidity to the main bracket, and to shield the oscillator components from the mixer valve. It measures 6½ in. long by 3¾ in. high, and extends right to the back of the chasis. This puts the main bracket 1¾ in. from the front panel, thus leaving room for the flexible coupling between the main dial and the variable oscillator's tuning condenser. A similar flexible coupling is also used between the panel trimming condenser and its knob. The exact positioning of the parts on the chassis is not important, as long as the general scheme of the lay-out is adhered to. Builders may please themselves about making the instrument somewhat more compact, but it will not be possible to group the parts on the main bracket much more closely, since this will bring the control knobs for the switch and the trimmer rather too close to the edge of the National N dial, which is four inches in diameter.

Intending builders are asked to note that only the best parts have been used in the construction, since this is a precision instrument, and nothing can be left to chance if the best results are to be obtained. For example, the wave-change switch has ceramic insulation. It was unfortunately necessary to purchase a switch with many more positions than necessary in order to get one with ceramic insulation, and this is the sole reason for the large number of unused contacts that can be seen in the photograph. In the centre of the bracket can be seen the midget Polar split-stator condenser used to tune the variable oscillator, and directly above it is the Philips trimmer which replaces one section when it is switched out of circuit in order to give extra bandspread, as described in the previous instalment. Opposite the wave-change switch is the front panel trimmer, used to zero-beat the variable and crystal oscillators. Directly beneath this are two ceramic feed-through insulators. The front one, nearest to the coil, terminates the lower end of the coil, which goes, via the grid condenser, to the oscillator grid. The other feed-through is connected to the cathode of the oscillator, so that the trimmer is connected to this by the vertical wire that can be seen running down from its stator plates. One of the 0.001 μf. condensers can be seen connected between the two feed-through insulators, above the chasis. On the right-hand side of the baffle shield (looking at the photograph) are the EF91 for the variable oscillator, a feed-through insulator which takes the aerial lead under the chassis for connection to the ECH21 circuit, and the ECH21 itself. The aerial terminal on the front panel takes the form of a feed-through insulator with a large knurled knob on front to act as a terminal.

A point to note is that all the variable oscillator's circuit above the chasis is wired with heavy bare tinned wire. This makes good rigid connections with no losses to cause frequency drift, and should on no account be substituted by insulated wire, unless one cares to use

(Continued on Page 41.)

R.T.M.F. Conference

(Continued from Page 23.)

ADVERTISING CAMPAIGN

Another important matter discussed at some length was the question of instituting a further advertising campaign. It was felt that the manufacturers should set aside a substantial sum for the purpose of publicizing their views on TV, and for furthering the sales of radio sets. Considerable divergence of views was apparent, however, on the subject of how a suitable basis for contribution to such a fund could be arrived at. It was felt by some members that unless the co-operation of the retailers and distributors, individually and collectively, could be obtained, an advertising campaign would not be a success. Others went even further, and suggested that no scheme should be envisaged which did not include the traders on a contributory basis. The principle of an advertising campaign was generally agreed upon however, and it was left to the incoming executive to devise ways and means of putting a scheme into effect.

RADIO INTERFERENCE

The Conference considered the case that had been prepared by Mr. Collier and presented to the Director-General of the Post and Telegraph Department on the subject of radio interference. This case is an extremely interesting document, and it is proposed to publish it in full in an early issue of *Radio and Electronics* on account of its importance, and of the interest which we are sure it will contain for all our readers. Mr. Collier has made a very complete study of the subject, and his submissions are of the greatest importance to the future development of radio services of all kinds. The Post and Telegraph Department, it was stated during the discussion, had power to compel the suppression of electrical devices proved to be causing interference, but had not yet been known to use those powers by prosecuting anyone who did not comply with their directions. It was decided to take further action to see if some enforcement of the existing regulations cannot be instituted.

ELECTION OF OFFICERS

The last-but-one item on the agenda was the election of officers for the ensuing year. Mr. T. J. F. Spencer was elected, unopposed, as the new President, and Mr. R. Slade was similarly elected as Vice-President. To the new office of Treasurer, Mr. W. Cunninghame was elected. Mr. Spencer, on assuming the chair, paid a warm tribute to the work of Mr. W. J. Blackwell, the retiring President, who had officiated in that capacity for three years. It was due to Mr. Blackwell's influence, said Mr. Spencer, that the Federation had progressed so much during this period, and in particular, he was to be thanked for the excellent spirit of co-operation that exists today, and which has enabled the Federation to become a real force for the good of the industry. Other speakers also paid tribute to Mr. Blackwell's work for the Federation, and a vote of thanks to him was carried by acclamation.

The final item of business was the fixing of the locale of the next annual conference, and it was decided that next year it should be held at Napier. Thus concluded what members described as the most valuable and successful annual conference yet held by the Federation.

THE "RADIO AND ELECTRONICS" ABSTRACT SERVICE

AUDIO EQUIPMENT AND DESIGN:

A problem often encountered by the audio constructor is the necessity for providing noise-free, high-gain amplification for low-level output transducers such as the playback head of a tape or wire recorder. Such problems may be solved by the once-popular phono oscillator.

—*Radio and Television News* (U.S.A.), Sept., 1950, p. 65.

The "expressor" system for transmission of music. In the reproduction of large orchestras, differences in sound levels may amount to about 80 db, and compression is therefore commonly applied, but this has drawbacks and systems of "expansion" have been devised for compensating for the compression. The "expressor" system here described, ensures that the degree of expansion is determined by the degree of compression.

—*Philips Technical Review* (Holland), April 1950, p. 281.

The release of long-playing records has aroused great interest in Great Britain, but the expensive item in the changeover is the change of motor. As the idea of converting the existing motor appeals, a few notes are given on the subject.

—*Wireless World* (England), Sept., 1950, p. 325.

The first broadcast of stereophony, the system in which sources of sound are restored to their relative positions in space, took place in France in June 1950. Two channels and two receivers are needed, the receivers being placed from 5 to 7 feet apart. The listeners' ears could follow a train as it started and crossed from left to right, and the impression of movement, conveyed by sound, was strikingly realistic. Acoustic depth is given to production related to human binaural hearing.

—*Ibid*, Sept., 1950, p. 327.

ELECTRONIC DEVICES:

A sensitive bridge-type photoelectric circuit. The self-generating type of photocell can be used to operate a D.C. relay directly without amplifier or power supply, but such a relay must operate on a few micro-amperes. A circuit for increased output sufficient to close a milliampere relay is described.

—*Radio and Television News* (U.S.A.), Sept., 1950, p. 76.

Considerable interest exists among amateurs regarding voice-operated keyers for automatic break-in of the transmitter, which helps to get the last ounce of power from the power tube. The circuit operates with a simple diode rectifier in the audio input, the rectified current operating a relay via the grid of an amplifier. Simplicity is the merit of this device.

—*QST* (U.S.A.), Sept., 1950, p. 28.

The locating and repairing of leaks in vacuum systems is probably the most troublesome aspect of high-vacuum technique. Major emphasis is on the helium leak detector, which rapidly indicates by meter the presence of helium ions in a leaky system.

—*Electronics* (U.S.A.), Sept., 1950, p. 96.

The electronic control of anesthesia—brain potentials, which increase as anesthesia decreases, are integrated and amplified to fire thyratron that actuates one-stroke electric pump for feeding more anesthetic to the patient to maintain the desired degree of anesthesia during an operation.

—*Electronics* (U.S.A.), Sept., 1950, p. 107.

A photometer for the electron microscope—correct photographic exposure is determined by a simple attachment. A multiplier photo-tube views the fluorescent focusing screen and beam intensity is indicated by a microameter. The apparatus may be useful for other purposes of measuring light intensity on surfaces.

—*Electronics* (U.S.A.), Sept., 1950, p. 110.

MATERIALS, VALVES, AND SUBSIDIARY TECHNIQUES:

A new power tube is the new 5881 beam-power tube, which is directly interchangeable with the 6L6 and which has additional ruggedness for heavy duty service.

—*Radio and Television News* (U.S.A.), Sept., 1950, p. 42.

Microspacer electrode technique is described—which is a novel technique for obtaining stable and extremely small spacings in valves. Its essential feature is the use of insulating spacers in glass, quartz, or plastic drawn down from convenient size to microscopic dimensions.

—*Proceedings of the I.R.E.* (U.S.A.), August, 1950, p. 871.

The I.R.E. has now set certain standards for electron tubes, and the methods of testing the characteristics, which should lead to better standardization and accuracy in design.

—*Ibid*, August, 1950, p. 920.

A survey of V.H.F. valve development, based on information supplied by the Mullard Valve Measurements and Applications Laboratory, reviews valves now available, especially in relation to transit time, and inter-electrode capacity.

—*Electronic Engineering* (Eng.), August, 1950, p. 310.

MATHEMATICS:

Microwave signals over line-of-sight courses are frequently observed to depart considerably from the free-space predictions. Reference is made to the "Fresnel Zone" and a nomograph is given relating frequency clearance and field intensity.

—*Electronics* (U.S.A.), September, 1950, p. 112.

A type of phase modulation system is described in which modulation of the phase angle of a carrier wave is brought about through an amplitude modulation process. The "phase converters" proposed consist of oscilloscope tubes in which the phospor has been replaced with a collecting anode, on which the phase modulation product appears.

—*Proceedings of the I.R.E.* (U.S.A.), August, 1950, p. 890.

A new theory of the magnetic amplifier which is an arrangement of saturable reactors and metal rectifiers which behaves as an amplifier of steady or slowly varying D.C. input power. This is a full mathematical analysis of the new theory.

—*Proceedings of the I.E.E., Part II* (Eng.), Aug. 1950, p. 460.

Most of the books on radio explain inductance-capacitance tuning at length but omit resistance-capacity tuning. R.C. oscillators are not just poor relations of L.C. oscillators, and the mathematics and use are here described.

—*Wireless World* (Eng.), September, 1950, p. 331.

MEASUREMENTS AND TEST GEAR:

The common or garden voltmeter is capable of much more than is generally supposed, and there is given methods of estimating resistance, checking impedance, internal resistance of batteries, amplifier power output, etc., with a few simple modifications.

—*Wireless World* (Eng.), September, 1950, p. 323.

A simple resistance-capacity oscillator is described, with good waveform and constant output. It employs two tubes to produce 15 volts R.M.S. output and covers a frequency range from 20 cycles to 2 M.C. in five decade ranges.

—*Electronics* (U.S.A.), September, 1950, p. 89.

Description of a home-built U.H.F. grid-dip oscillator which covers a range of 170 to 450 m/secs., and higher than any other published circuit. It employs the "butterfly" tuner which is a unique arrangement of a variable condenser and variable inductor in parallel, which can be home-made. This is undoubtedly an excellent instrument for experimenters in the high frequency ranges.

—*Radio and Television News* (U.S.A.), Sept. 1950, p. 47.

An oscilloscope preamplifier with a simple circuit is described as an addition to older or inexpensive oscilloscopes with a low sensitivity and which need a little boosting for present-day work.

—*Ibid*, September, 1950, p. 53.

MICROWAVE TECHNIQUES:

An additional study of wave-guides—history, a descriptive account of electrical transmission by these mediums, in comprehensive and simple form with a minimum of mathematics.

—*The Bell System Technical Journal* (U.S.A.), July 1950, p. 295.

RECEIVERS:

In building a multi-band receiving device for V.H.F., the conventional methods of band changing leave much to be desired, the best plug-in coils or band-switches being limited to about 144 m/secs. A crystal controlled oscillator and a fixed tuned front-end simplify the mechanical and electrical problems. The set-up is described here in detail.

QST (U.S.A.), September, 1950, p. 11.

TELEVISION:

One of the most elusive types of interference encountered by the television serviceman is the black line on the raster caused by an internal oscillatory action in the horizontal output tube and is the result of a phenomenon known as "the Barkhausen effect." The interference may be cured by minor circuit adjustments.

—*Radio and Television News* (U.S.A.), September, 1950.

The case for colour television. A committee of inquiry in its report on the status of colour TV, recommends new V.H.F. channels, argues against U.H.F., and calls for a review in the U.S.A. of the allocation policies in regard to frequency.

—*Electronics* (U.S.A.), September, 1950, p. 67.

A description of frequency-interlaced colour television. Red, blue, and green picture signals are transmitted simultaneously, with good fidelity over the standard 6 m/sec. channel. The system described requires the addition of only six tubes to convert the circuits for a tricolour tube.

—*Ibid*, September, 1950, p. 70.

TRANSMITTERS AND TRANSMITTING:

The August number of "Electronic Engineering" deals largely with the planning of V.H.F. mobile stations, such as are now coming into use for taxis, police communications, and the like. The advancements made and the design and frequency problems are fully discussed.

—*Electronic Engineering* (Eng.), August, 1950, p. 297, *et seq.*

Instructions are given for the making of a light-weight portable transmitter-receiver for the hiker.

—*QST* (U.S.A.), September, 1950, p. 15.

MISCELLANEOUS:

Experiments with a device similar to the Bell Transistor, but with a high input impedance, are reported. In the present stage of development is appears useful as an impedance transducer with appreciable current and power gain at lower frequencies.

—*Proceedings of the I.R.E.* (U.S.A.), August, 1950, p. 868.

The "R. and E." Senior Communications Receiver

PART IV

ABOUT THE CONSTRUCTION

The receiver is built in two units, one containing the tuner, and the other, the "back end" and the power supply. Since we are dealing with the latter section, the illustrations are of its chassis, measuring 16 in. x 10 in. Fig. 1 gives a plan view of the completed chassis, and together with the chassis diagram printed in an earlier instalment, will serve to identify the various valves. The lower edge of the photograph is the *front* edge of the chasis, which may not be apparent, since the control shafts have been cut out of the print. In order

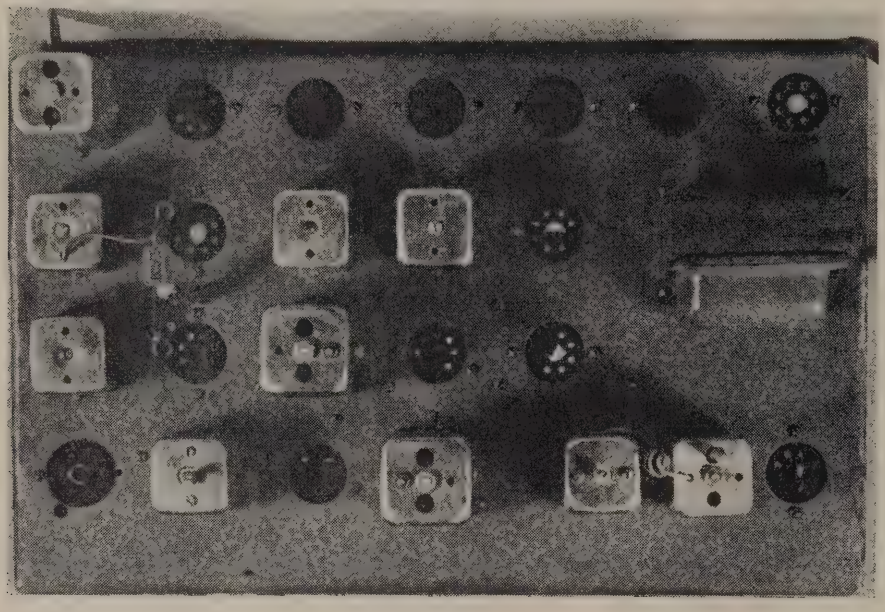


Fig. 1.

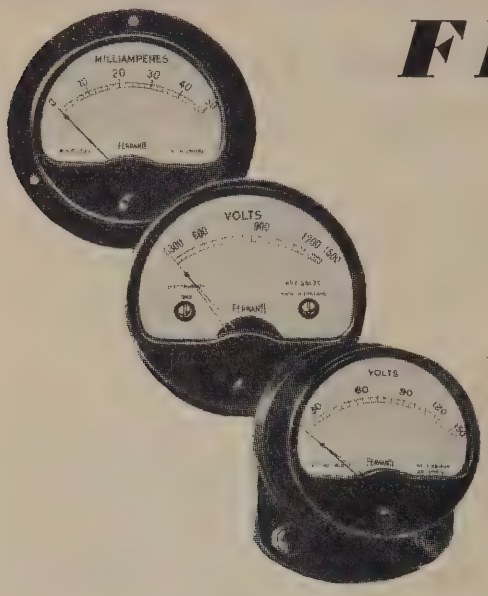
that readers can visualize the circuit in relation to the chassis, our first step will be to identify the valve sockets and also the coils and transformers that are mounted on the chassis top.

In the left-hand bottom corner is V_1, the ECH21 first 455 kc/sec. I.F. amplifier. Its input circuit is under the chassis, including the shielded coil L_1, which cannot be seen in this view. Then, directly above V_1 we have L_2 and L_3. The adjusting screws for these coils come out from the bottom of the coils, and are visible in Fig. 2, the under-chassis view. From the top of L_3's can comes the grid lead for V_2, the 6AR7-GT, second 455 kc/sec. I.F. amplifier valve, whose socket is immediately to the right of L_3. Then, carrying on in the same horizontal row are L_4 and L_5, following by V_3, the 6H6, 455 kc/sec. detector and noise-limiter tube. Now, going back to V_2, we have directly in front of it, the socket for V_4, which is the X61M oscillator-mixer valve converting from 455 kc/sec. to 100 kc/sec. The grid cap of V_4 is connected through a 50 $\mu\mu$f. blocking condenser, to the grid of V_2, and this condenser can be seen in the photograph, together with the grid leak, R_4, which is also above the chassis. Between the two sockets (V_2 and V_4) can be seen a small insulating soldering tag which terminates the lower end of R_4, and enables a wire to be taken through the chassis to the A.V.C. line. Then, directly in front of V_4 is the oscillator coil for this conversion, T_2 on the circuit diagram. The first 100 kc/sec. I.F. transformer, T_1 is immediately to the right of V_4. Then, to the right of T_1 is V_5, the first 6SW7 amplifier tube. The second 6SG7, V_6, is diagonally to the left of V_5, and therefore in the front row, to the right of T_2. To the right of V_6 is T_3, the 100 kc/sec. output transformer, and this feeds the 100 kc/sec. detector V_7, above it, and to the right. The valve in the lower right-hand corner of the chassis is V_{15}, the 6SN7 dual B.F.O. tube, and in the front row, to its left, are the two B.F.O. coils, L_7 and L_8.

The row of sockets along the back of the chassis (the top row in the photograph) is reserved for two rectifiers (H.T. and bias), a V.R. tube, two audio valves, and V_{11}, the noise rectifier for the Lamb noise suppressor. The noise amplifier valve, V_{10}, is mounted under the chassis and can be seen in Fig. 2.

CONSTRUCTION—GENERAL

The first essential in putting together a complex piece of circuitry like this one is to have a well-made chassis. In this case, the requirement for a good chassis is more marked than usual, because with the extreme selectivity that is possible from the 100 kc/sec. channel, it is imperative that not the slightest mechanical deformation take place when the set is handled, both during alignment or while the set is in use. Frequency stability is an absolute necessity, or else the user will find stations, tuned in with very high selectivity, will drift off tune when the controls are adjusted, or through bending of certain critical parts of the wiring. Accordingly, the prototype was built on an abnormally heavy steel chassis —16 gauge, to be exact—and it is strongly recommended that builders should do the same, even though it means that they will have to get a chassis made professionally rather than make it themselves. A chassis of this size made of 16 gauge steel is rigid enough not to need any bracing, and will stand any amount of moving about, and a great deal of weighty parts on it, without the slightest "whip" in any direction. This is a very definite "must" for this circuit. Another essential is to construct the under-chassis baffle shielding exactly as shown in the diagram that was printed in the last instalment. This is quite complicated, but necessarily so, since if the 100 kc/sec. circuit is to be successful, there must be no trace of undesired feedback, and it is the baffle-shielding that ensures this. The 100 kc/sec. amplifier, with its two lots of feedback, is a most awkward one to lay out, and it is thought that the lay-out chosen represents possibly the best that can be done. It will be noted that the



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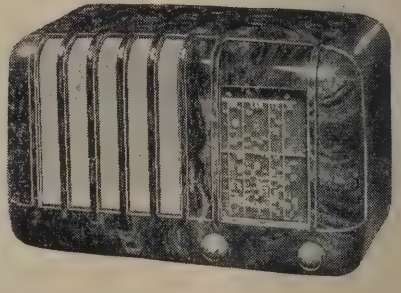

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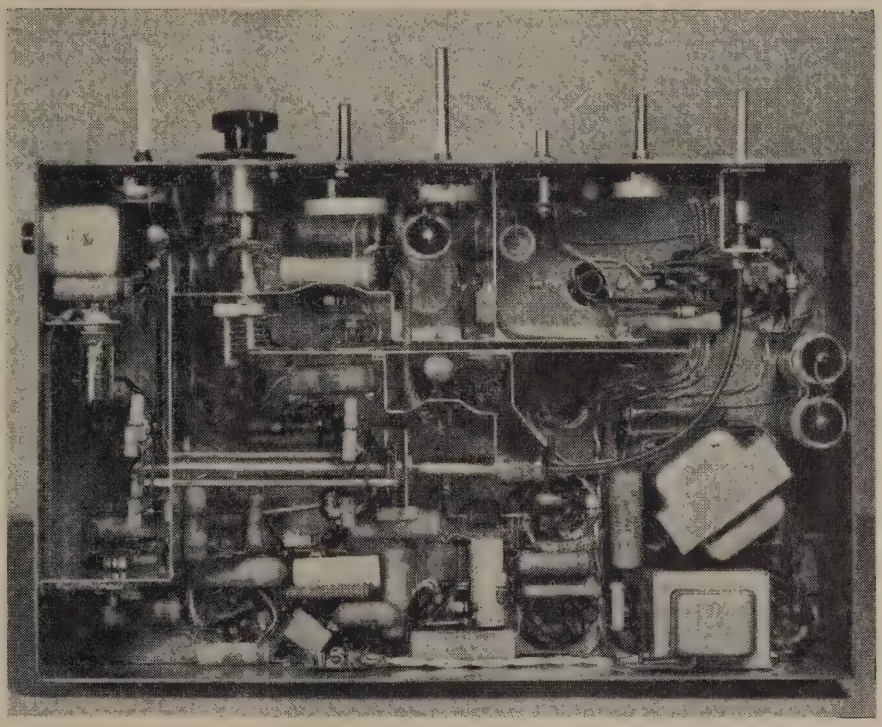


Fig. 2

complicated part of the underneath shielding is concentrated round this part of the circuit, the rest being quite simple. What the shields provide, however, is double shielding between the two amplifier valves and the input and output transformers. These four components are mounted at the four corners of a square, with the transformers at the ends of one diagonal, and the valves at the ends of the other. It was necessary to do this so as to have V_6, the second tube, in the front row, and as close as possible to the front of the chassis, as this enabled the selectivity potentiometer, R_{12}, to be mounted on the panel itself, and yet to have a very short lead to the plate of V_6. The shielding at the same time provides cross-socket shielding for V_5 and V_6, which are both single-ended valves, and which might themselves oscillate or at least regenerate without such shielding. A glance at the under-chassis photograph shows that two main pieces of shielding run parallel with the front panel, and between the two sockets. The front one of these pieces turns at right-angles towards the chassis front, and then to the left again after an inch or so, to go across the socket of V_6. Then, attached to the back main piece, is a second small bit which comes back and then across to the right, across the V_5 socket. To the right of this is another piece, at right-angles to the first, and then bent at an angle to the right, partially surrounding the socket of V_7. This is needed because it is necessary to shield the 100 kc/sec. output, which is fed to V_7. This is needed because it is necessary to shield the 100 kc/sec. output, which is fed to V_7, from the 100 kc/sec. input, which is close handy, at the grid of V_5. The two main shield pieces are extended to the right so as to give some protection against unintentional feed-through from the B.F.O. wiring, in the right-hand corner of the chassis. For the same reason, and also to add rigidity to the baffle shielding structure, a piece is brought from the front panel, between the manual gain control and the 455/100 kc/sec. change-over switch, to the front main shield. At the left-hand side of the chassis can be seen a long piece of shielding parallel with the left-hand edge of the chassis. This also turns at right-angles, near the back of the chassis, and bolts to the left-hand edge. Towards the front, it is attached to the shielding that comes across from the V_3 socket, so that there are no portions of the aluminium shield partitions that are not supported rigidly. The last-mentioned piece is made use of as a mounting for the fine tuning control C_5, just in front of the socket V_4. This condenser is fitted with a flexible coupling to the small planetary-drive reduction gear that is part of the small calibrated dial. This control is the second from the left in the photo.

Use is also made of the baffle shielding to mount other components, thereby making a virtue of necessity. For example, the wave-change type switch which is the 455 kc/sec. selectivity control, can be seen mounted parallel to the front panel, and with its flexible drive to the extreme right-hand control knob. The front end of this switch is actually mounted on the left-hand baffle shield, with its wafer inside the compartment on the extreme left. This wafer controls the coupling between L_2 and L_3, and the associated fixed condensers can be seen festooned round it. The remaining wafer, controlling the coupling between L_4 and L_5, is right at the other end of the supporting shafts, and is placed right between L_4 and L_5. The adjusting screws for these latter coils can readily be seen in the photograph.

LAY-OUT OF THE LAMB NOISE SUPPRESSOR CIRCUIT

This is a little unusual, and resulted from the difficulty of putting all the parts for this part of the circuit close to V_1, on which it operates, without making the chassis unduly large and spread out. In the compartment to the extreme left of the chassis can be seen the can for L_1, mounted on the side of the chassis. The idea of this was to put the inside half of the Amphenol input connector actually inside the can of L_1. This can is directly above the socket of V_1, and is only put in after the rest of V_1's wiring has been completed. These single 455 kc/sec. coils come from the maker with the adjusting screw for the tuning slug protruding from the bottom, and thus conflicting with the position of the input plug. Accordingly, a hole was cut in one *side* of the can, large enough for the coil to be mounted across the can instead of along it. The holding screw thus mounts on the opposite side of the can to the one which was drilled out for the end of the coil former, and this screw can be seen in the photograph, Fig. 2. In the top-chassis view, Fig. 1, a small hole can be seen in front, and a

little to the left of the V_1 socket. This is there to give access to the adjusting screw of L_1, with its new method of mounting.

Just in front of the L_1 can in Fig. 2 can be seen a small bracket holding the socket for V_{10}, the 6BA6 noise amplifier tube. The grid of this valve is fed from the plate pin of V_1 via a blocking condenser, C_{28}, and this position gives the lead a very short run, hereby aiding stability since the 6BA6 has quite high gain when opened up by the threshold control, R_{41}. Now the noise amplifier transformer, T_4, is quite a long way from V_{10}, and is, in fact, at the left-hand lower corner of Fig. 2. This gives a long run for the plate lead of V_{10}, so that it is imperative to use shielded wire for this connection. This wire can be seen running round the left-hand edge of the chasis, through the shield partition, and down to the transformer, T_4. The output of the noise rectifier, whose socket is just next-door to T_4, goes first of all to the choke, L_8, which can be seen mounted on the baffle shielding close handy, and thence through shield braid along the bottom of the chassis back to V_1. Note that both these runs of shield braid should be earthed to the chassis at *each end*, not just at one end. The threshold control is on the front panel, at the extreme left, and long unshielded leads are run back to the V_{10} circuit. It should be noted that these leads do not need shielding, because they carry nothing but D.C. But just to make sure, the bypassing at the moving arm of R_{41} is doubled, one condenser being at the potentiometer itself, and the other at the cathode pin of V_{11}. The wire is thus bypassed at both ends, which helps to ensure that it is "cold" as far as R.F. is concerned.

THE CONTROLS

Except for the two B.F.O. tuning condensers, all the controls are in a row along the bottom of the panel, and reading from left to right, they are: (1) Noise suppressor threshold, R_{41}. (2) Fine tuning on the 355 kc/sec. oscillator, C_5. (3) 100 kc/sec. selectivity control, R_{12}. (4) Manual gain control, common to both channels, R_{47}. (5) 455/100 kc/sec. change-over switch. (6) Audio gain control, and (7) 455 kc/sec. selectivity control, Sw_1.

POWER SUPPLY AND AUDIO CIRCUITS

These are quite straight-forward, and their circuits will be presented in the next instalment of this article. The circuit includes a 6X5-GT arranged as a bias rectifier, and which provides the —50 volts needed for the manual gain control. It also includes a VR105, which provides regulated H.T. voltage for the B.F.O.s, and for certain parts of the tuner.

(To be continued.)

THE NEW ZEALAND ELECTRONICS INSTITUTE (Inc.) NEWSLETTER

HEADQUARTERS NEWS
MESSAGE FROM THE PRESIDENT

Mr. L. W. Harrison, B.E., B.Sc., A.M.I.E.E., M.N.Z.I.E., President of the N.Z. Electronics Institute.

The President of the Institute, Mr. L. W. Harrison, has written the following Christmas message to all members of the Institute, specially for the Newsletter. Mr. Harrison writes:

May I take this opportunity of extending to all members of the New Zealand Electronics Institute the best wishes of the council and myself for Christmas and the forthcoming New Year.

The science of electronics, and in particular that of the thermionic valve, has developed rapidly in the space of a few years and is already responsible for many of the services which we now consider essential to our normal everyday life. The outstanding ones are telecommunications, radio broadcasting, radio navigational aids, high-frequency medical treatment, X-rays, and fluorescent lighting. It seems likely that we will soon have television added to these in this country. Industry, also, has benefited by devices in the shape of high-frequency heating, automatic control gear, high-speed counting, and thermionic rectifiers.

For those actively engaged in electronic engineering there is no better way of discussing mutual interests and problems, and of improving knowledge, than through the medium of the branch meetings of the Institute. Although a comparatively new organization, the Institute is now "on its feet," and membership is steadily increasing. The greater the membership, the greater will be the benefits to be obtained by all members, and I therefore suggest to all members that they should help the Institute by endeavouring to enrol as many new members as they can and make next year a record year.

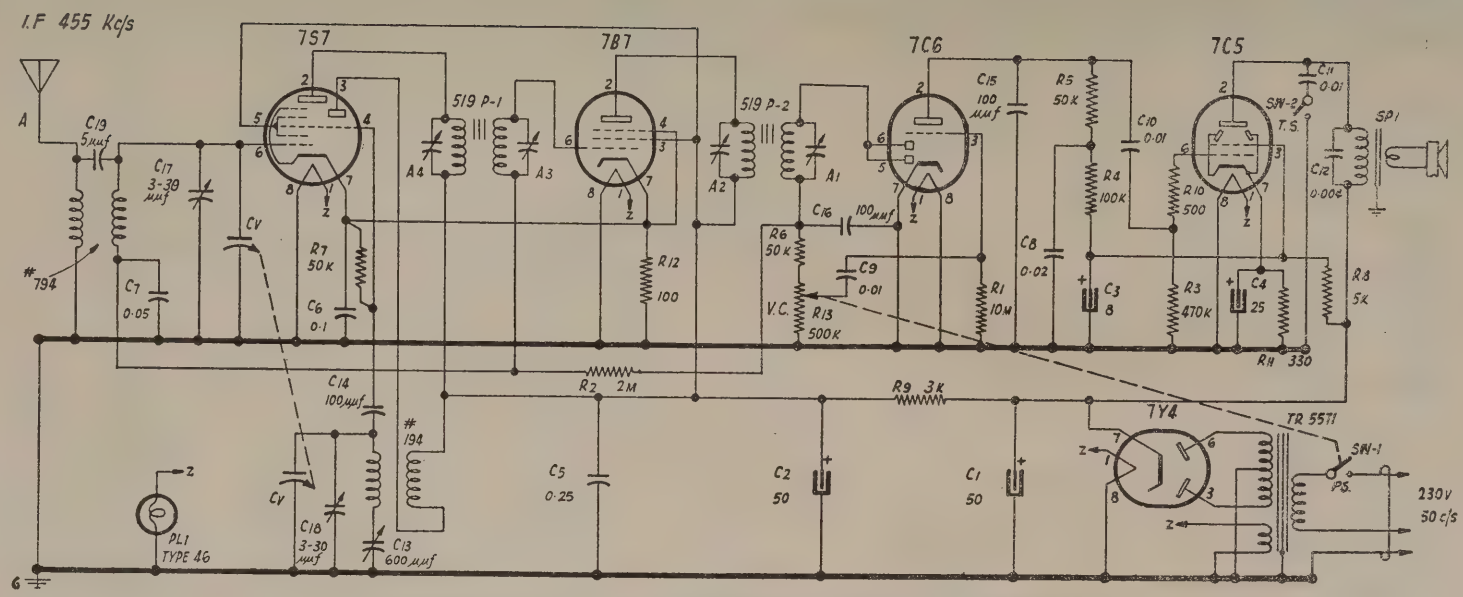
BRANCH NEWS

Christchurch.—The last meeting of the Christchurch Branch was held on Monday, 30th October, at 7.30 p.m., in the Recording Studios of the New Zealand Broadcasting Service, 3YA, Gloucester Street, and the speaker was Mr. T. C. Agar, who spoke on "Modern Recording Technique." This covered improved methods of disc recording and the latest in tape recording. Methods used in conducting noise and distortion tests were also shown. Mr. Agar has been associated with the Recording Division in Christchurch since its commencement, and a vote of thanks to Mr. Agar was passed by those present, who enjoyed the evening.

Dunedin.—Following on a recent monthly meeting of the Dunedin Branch, Mr. C. R. Anstice, of the Electricity Department, gave a lecture on "A.C. to D.C. Mercury Arc Rectification." The lecture was followed by a visit to the new rectifier stations. The lecture given by Mr. Anstice dealt with the basic principles of mercury arc rectification and with transformer circuits and characteristics particularly designed to supply the power to operate the trolly-bus service. After supper, those present were taken on a visit to the installations in the main rectifier station and then to the automatic station newly built in King Street. The technical aspects of the operation of this station were explained in detail by Mr. Anstice, and members were fortunate in having Mr. Anstice to supply any information desired. The whole evening was a most enjoyable experience, and the thanks of the Institute are due to Mr. Anstice, and also to Mr. Edgar, through whose courtesy the visits were possible.

Wellington.—A novel touch to the monthly meeting of the Wellington Branch was given recently when, instead of meeting at 7 p.m., members and visitors gathered together at 5.30 p.m. on Wednesday, 8th November, 1950, in the Conference Room, Air Department, Bunny Street. Tea and sandwiches were served, followed by the meeting, which took the form of a "Questions and Answers" evening, at which the following subjects were dealt with: (1) V.H.F. Airborne Equipment, Mr. F. R. W. Andrews (Civil Aviation Branch); (2) Practical Aspects of the Application of V.H.F. to Mobile Services, Mr. R. Simon (Assistant Radio Engineer, P. and T. Department).

FOR THE SERVICEMAN—H.M.V. "Little Nipper" Model 495 B.C.



SCHEMATIC DIAGRAM MODEL 495BC.

VOLTAGE READINGS

Use	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
Conv.	7S7	6.3 a.c.	107	107	—5	107	0	2	—
I.F.	7B7	6.3 a.c.	107	107	2	—	0	2	—
Det-AF.	7C6	6.3 a.c.	95	0	—	0	0	—	—
Output	7C5	6.3 a.c.	145	145	—	0	0	7.9	—
Rect.	7Y4	6.3 a.c.	145	155 a.c.	—	—	155 a.c.	150	—

RESISTANCE READINGS

Use	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
Conv.	7S7	—	0.5 meg	0.5 meg	50K ohm	0.5 meg	2.5 meg	100 ohm	—
I.F.	7B7	—	0.5 meg	0.5 meg	100 ohm	—	2.5 meg	100 ohm	—
Det-AF.	7C6	—	0.5 meg	10 meg	—	0.5 meg	0.5 meg	—	—
Output	7C5	—	0.5 meg	0.5 meg	—	0.5 meg	0.5 meg	330 ohm	—
Rect.	7Y4	—	0.5 meg	240 ohm	—	—	240 ohm	0.5 meg	—

1. D.C. voltage measurements are at 2,000 ohm per volt—A.C. voltage measurements at 1,000 ohm per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Nominal tolerance on component value makes possible a variation of ± 10% in voltage and resistance readings.
5. Volume control at maximum, no signal applied for voltage measurements.
6. Resistance readings in B+ circuits may vary widely according to condition of filter capacitors.

"LITTLE NIPPER"
MODEL 495BC.

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BROADCAST RECEIVER MODEL 495BC.
SERVICE DATA SHEET

TYPE SET—A.C. Superhetrodyne. Moulded Bakelite Cabinet.

TUBES (Five)—7S7 Converter, 7B7 I.F. Amp. 7C6 Det.-A.F., 7C5 Power Output, 7Y4 Rectifier.

POWER SUPPLY—230 v. A.C. Rating 25 watts.

TUNING RANGE—Broadcast 535-1540 K.C.

ALIGNMENT INSTRUCTIONS

To set pointer, fully mesh condenser and set pointer at last reference mark at left end of dial. Set volume control at maximum and keep output from signal generator no higher then necessary to obtain output reading.

Dummy Antenna	Signal Generator Coupling	Sig. Gen. Frequency	Band Switch Position	Radio Dial Setting	Output Meter	Adjust	Remarks
0.1 μfd.	High side to grid of 7S7	455 Kc.	———	High freq. end	Across voice coil	A1, A2, A3, A4.	Adjust for maximum output
R.M.A. Standard	High side to ant. terminal	1400 Kc.	———	1400 Kc.	"	C18	" "
"	" "	1400 Kc.	———	1400 Kc.	"	C17	" "
"	" "	600 Kc.	———	Rock Variable	"	C13	" "

CAPACITORS

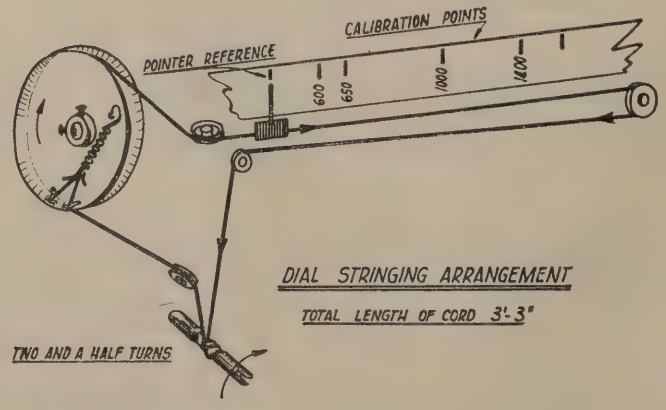
Ref. No.	Cap.	Volts
C1	50 μfd.	250
C2	50 μfd.	250
C3	8 μfd.	250
C4	25 μfd.	25
C5	0.25 μfd.	400
C6	0.1 μfd.	400
C7	0.05 μfd.	400
C8	0.02 μfd.	400
C9-11	0.01 μfd.	400
C12	0.004 μfd.	mica
C13	600 μμfd.	padder
C14-16	100 μμfd.	mica
C17-18	3-30 μμfd.	trimmer
C19	5 μμfd.	ceramic

MISCELLANEOUS

Ref. No.	Res., Pri.	Res., Sec.	
519P-1	7 ohm	7 ohm	
519P-2	7 ohm	7 ohm	
794	16.5 ohm	2.7 ohm	
194	0.82 ohm	2.3 ohm	
	Volts	**Volts**	**Volts**
TR5571	230	175 aside	6.3
	Type	**Transformer**	
SP1	5" P.M.	5000 ohm	
SW1	S.P.S.T.	Switch attached to R13	
SW2	S.P.S.T	Tone Switch	

RESISTORS

Ref. No.	Res.	Watts
R1	10 meg	½ watt
R2	2 meg	½ watt
R3	470K ohm	½ watt
R4	100K ohm	½ watt
R5	50K ohm	½ watt
R6	50K ohm	½ watt
R7	50K ohm	½ watt
R8	5K ohm	½ watt
R9	3K ohm	1 watt
R10	500 ohm	½ watt
R11	330 ohm	½ watt
R12	100 ohm	½ watt
R13	500K ohm	Pot



BASS COMPENSATION

Bass compensation has been achieved by the combination of values chosen for the plate-feed circuit (R4, R5, C8) of the 7C6 stage.

The change of reactance of C8, with frequency, modifies the effective plate-load impedance presented to the tube.

This results in a greater gain as the frequency is reduced.

TRADE WINDS

NEW ZEALAND RADIO MANUFACTURERS' FEDERATION CONFERS AT CHATEAU TONGARIRO

On the 30th and 31st October, the New Zealand Radio Manufacturers' Federation held what was described as the most successful annual conference yet, in the pleasant if somewhat bracing atmosphere of the Chateau Tongariro. Members and their wives travelled to the Chateau on Saturday, the 28th; Sunday was spent settling in and in viewing those parts of the mountain that were not covered in cloud; and the conference proper got down to business on the Monday. There was an air of expectancy in the lounge after dinner on the Saturday night, and while the members and their wives were renewing old friendships and making new ones, it was apparent from the snatches of conversation to be heard from the various groups that the men were somewhat eagerly awaiting the formal discussions that the agenda paper, already circulated, showed were going to be of more than ordinary importance in the scheme of things that the industry has mapped out for itself in the ensuing year. In spite of the large number of important matters that were to be discussed, however, one word was in everybody's thoughts —television. It was known that the Federation's executive committee had been giving more than passing thought to this hitherto somewhat controversial subject, and that the president (Mr. W. J. Blackwell) had some very interesting and important views to put before the conference on the executive's behalf, so that it was hardly surprising that throughout the three days or more that the members spent together TV was the item that came uppermost in very short order, whenever a small group was diverted to talking "shop." One very well-known executive who is devoted to photography could not even refrain, when discussing his hobby, from discoursing on the subject of the challenge of TV to the photographic industry, to produce emulsions as sensitive as the latest TV camera tubes!

Television was really in the news that week-end, for not only was it to be a major topic of discussion at the conference, but the Minister of Broadcasting (Hon. F. W. Doidge), just returned from Great Britain and the U.S.A., had come back bubbling over with enthusiasm for TV as a new medium of home entertainment that was not beyond New Zealand's reach, as everyone had previously assumed—except, of course, the N.Z.R.M.F., as events subsequently proved.

* * *

The National Electrical and Engineering Co. announces that it has a useful library for technical and semi-technical 16 mm. films, all available for loan on a no-charge basis. Among the films available are a number featuring arc and resistance welding, electronics, street lighting, Radiotron valve manufacture, cable making and jointing, electric traction, etc., all being interesting and informative films particularly suitable for the film evenings of local electrical institutes and similar bodies.

Inquiries should be marked for the attention of the Publicity Department, Head Office, Wellington, and an indication given of the evening for which a film or films will be required. A list of films will be supplied on request.

* * *

The appointment of Mr. A. R. Dellow as general secretary has been confirmed by the New Zealand Manufacturers' Federation, following the resignation of the former secretary, Mr. D. I. Macdonald, to accept office as a member of the Import Advisory Committee.

NOTICE

THE PATENTS, DESIGNS, AND TRADE-MARKS AMENDMENT ACT, 1939

ASSIGNMENT WITHOUT GOODWILL PURSUANT TO SECTION 24

TRADE MARK No. B38343

ROLLS

The above-numbered trade-mark registered in Class 8 (Third Schedule) in respect of radio apparatus of all kinds, parts thereof, and accessories therefor, and all types of electrical goods included in Class 8, was assigned on the 12th day of June, 1947, by STEVENS AND SONS LIMITED, a company incorporated under the laws of the Dominion of New Zealand, whose trade or business address is 99 Ferry Road, Christchurch, New Zealand, Manufacturers and Merchants, to H. C. F. STEVENS & COMPANY LIMITED, a company duly incorporated under the laws of the Dominion of New Zealand, of 36–38 New Regent Street, in the City of Christchurch in the said Dominion, Manufacturers, *without the goodwill* of the business in which it was then in use.

Jenner's Music Store, Lower Hutt, announces that it has taken over the business of J. R. Maunder, Levin, to be carried on as a radio and musical store under the management of Gordon Burrow. Gordon was at one time with the Post and Telegraph Department, Technical Section, and joined Messrs. Jenners a year ago. Replacing Gordon at Lower Hutt is Norm. Williams, late of Wireless Service, Napier.

* * *

Glancing over the pages of history of one of our advertisers, we see that just fifteen years ago this firm started making electric ranges in an improvised factory situated in a portion of their office and warehouse premises. From this small beginning sprang the Neeco range, and, of the three-plate model alone, 50,000 have since been produced.

* * *

Miles, Nelson, Ltd., advise a correction to their original announcement relating to their premises at Christchurch in that the address now is 170 Manchester Street.

* * *

PUBLICATIONS RECEIVED

From the Radio Industry Council, England, Specification No. R.I.C./1000/B, "Choice of Finishes for Radio and Other Electronic Equipment and Components Therein," Issue 1. This is a companion specification to No. R.I.C./1000/B dealing with choice of finishes

Muirhead Technique, July, 1950.

Westinghouse Engineer, September, 1950.

Radiotronics, October, 1950.

Sylvania News, August, 1950.

H.M.V. Listeners' Guide, Revised Log Chart, 1950.

Wireless World Pocket Diary, 1951, by Iliffe & Sons, Ltd. Size 4½ in. x 3⅛ in. wide; 80 pages of reference material. The reference section includes a large selection of handy formulae, abacs for easy graphical estimation of such things as coil windings and circuit constants, lists of unit abbreviations, definitions, and classifications, with a number of useful circuit diagrams. The valve base tables give connections for more than 500 valves in convenient form.

(Continued on Page 48.)

"For want of a Radiotron!"

For want of a Radiotron a radio is silenced! For want of a Radiotron an expensive piece of electronic equipment may be idle! For want of a Radiotron urgent communications can be held up.

Radiotron Valves are seldom found wanting. And Radiotron replacements when needed are quickly obtainable. Firstly, through the network of Radiotron dealers throughout New Zealand. Secondly, through the eight branches of the N.E.E.Co. as distributors. Lastly and most importantly, through the A.W.V. Radiotron factory only eight aero-hours away in Sydney.

For dependable service, install Radiotrons as first equipment. For super service, always revalve with Radiotrons.

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VALVES

New Zealand Distributors:

The NATIONAL ELECTRICAL AND ENGINEERING CO. LTD.

AUCKLAND WELLINGTON CHRISTCHURCH DUNEDIN HAMILTON
WANGANUI HASTINGS INVERCARGILL

Philips Experimenter

(Continued from Page 25.)

heavy enamelled wire. This, however, is much more trouble to use.

The coil former is of polystyrene, and is made from a plug-in coil former. It would have been possible to use one of these "as is," but this was considered bad practice, because there is no possible need for changing coils, and however good the socket, the mounting is not really rigid. Also, the coil terminals were wanted on top of the chassis rather than underneath. To make the former, the original one was modified by cutting off the base, with the pins, with a hack-saw. These formers also have a flange on the top, and this was retained. Next, the mounting ring from an Amphenol type valve socket was filed out until it would slip over the 1¼ in. diameter former. As can be seen in the photo, this ring is used to hold the former to the chassis, being firmly screwed down with two nuts and bolts, using the original mounting slots. At each end of the former, small holes are made, to take solder-lugs of the type that end in a rivet. These lugs are inserted (having taken care to slip on the mounting plate beforehand) and the former is ready for the coil to be wound.

The valve all on its own in the left-hand corner of the chassis is the EF91 crystal oscillator tube. It is mounted well clear of the rest of the circuit so that there will be little or no stray coupling to the mixer. If this is not done, there may be so much voltage injected into the mixer purely by stray means, that good beats are not obtained, and no control of the injection is possible. This contingency is easily avoided in the layout shown and beats are almost non-existent if the intentional coupling condenser is disconnected. It is thus possible to organize the strength of the beats quite easily by varying the size of the coupling condenser.

The underneath view shows that here, the construction is very simple, there being only a few small parts, and plenty of room to put them. Note the shielded lead from the crystal oscillator along the back of the chassis, and the shielded lead from the mixer to the A.F. amplifier to the gain control and the 'phone jack. The crystal is a small wire-in unit, and can be seen directly over, and obscuring the oscillator's valve socket.

In case we are taken to task for not including a power supply on the chassis, especially when there is plenty of room for it, we would say that the matter was considered, and omitted purposely. One of the main difficulties in stabilizing a meter of this kind is in keeping heat as far as possible from the tuned circuit components. There are already three valves inside the box (when the unit is covered up, as it should be) and even though their plate currents are well down, they generate enough heat on their own account without adding extra sources inside the box.

A point to watch is that the cover which boxes in the works should have plenty of holes, both high up and low down, so that the air can come in the lower ones, and chimney up through the top ones after circulating inside. This will keep the inside much cooler than if no ventilation is provided.

THE OSCILLATOR COIL

The oscillator coil consists of 27 turns of 28 gauge enamelled wire on the 1¼ in. polystyrene former. The turns are spaced by one wire diameter by the usual method of winding two wires side by side and then let-

(Continued on Page 48.)

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

ULTIMATE ELECTRIC KETTLE

Model 320

The Ultimate kettle is made from the finest spun copper and heavily nickelled and chrome plated and is a popular and reliable appliance.

The special feature of the kettle is that it is designed so that it is not easily knocked over and it is easy to fill and pour. Some outlet louvres in the lid of the kettle afford protection to the user's hand, and non-corrosive feet keep the kettle base away from the table top or bench.

The Ultimate kettle is equipped with a sturdy long-life element giving fast boiling and absolute protection with its double earthing safety clip. The Ultimate 320 kettle is equipped with a chrome steel and black phenolic handle and black moulded knob. Of three pints capacity and rated at 1,500 watts at 230 volts. The kettle carries a 6 foot flexible cord with durable appliance plug.

Price retail **£3 15s.**

ULTIMATE ELECTRIC JUG

In the November issue the price for this was inadvertently quoted at £3 15s.—this should have been £3 17s. 6d.

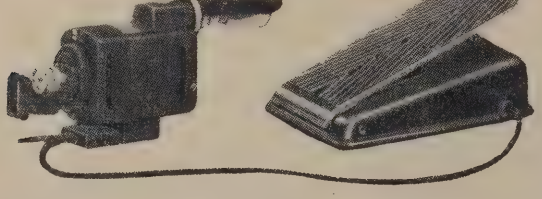
* * *

PARVALUX DOMESTIC SEWING-MACHINE MOTOR

Type S.D.3. combined foot switch and five-stage speed control.

This "Parvalux" sewing-machine unit, developed primarily for the domestic user, is capable of driving the machine continuously without fatigue or overload for eight-nine hours a day if required.

The foot control, with inclusive on/off switch, is a departure from accepted design practice inasmuch as



the working parts have been greatly simplified. An additional refinement is the non-slip rubber feet that will not mark or scratch the most highly polished floors.

Technical Specification

Voltage Range.—100/20 or 200/50 universal.

Bearings.—Plain self-oiling, self-aligning type complete with felt pads, with provision for additional oiling included in bearing caps.

Brush Gear.—A unique design that makes for long brush life and good commutation. Brushes easily renewable by removal of inspection plates.

Rating.—1/20 h.p. continuously rated to B.S. Specification. Ventilated frame with internal fan cooling.

Leads.—First-grade three-core circular flexible with included earth wire.

Finish.—Motor unit finished in black wrinkle, with plated fittings and polished needle light reflector (when fitted). Foot control body of black bakelite with polished aluminium foot pedal.

Weights.—Complete unit with needle light, 3¾ lb. net; without needle light, 3½ lb. net.

New Zealand Distributors, Swan Electric Co. Ltd.

* * *

EDISWAN TAPE RECORDER AND CINE-SOUNDMASTER

The National Electrical and Engineering Co., Ltd., announces interesting new products to be marketed by their principals, the Edison Swan Electric Co., Ltd. These are a magnetic tape recorder and a new development, the Cine-Soundmaster, designed to convert silent-type film projectors to sound-film projectors.

The Ediswan tape recorder is a light, compact, portable equipment, extremely simple to operate. Using a magnetic tape as a recording medium, it gives faultless reproduction and has an almost unlimited range of applications in the recording of speech, music, etc., or as a dictation recording and reproducing unit. A pedal-operated device enables the typist to run the instrument at a low speed.

Each reel of tape gives a recording time of approximately 30 minutes, and once the recording is made it can be kept indefinitely, if required, without deterioration. Alternatively, the tape may be used over and over again by employing an erasing unit which automatically eraces the previous recording as a new recording is made.

The recorder operates from the standard mains supply and uses less power than the average radio receiver.

(1) Strong covered case with detachable lid; (2) recording/erasing head housing; (3) slot for tape (tape is dropped into slot—no complicated threading); (4) take-up reel; (5) record/playback switch; (6) control knob (connects necessary circuits for rewind—stop—record); (7) recording time indicator (shows minutes of recording time remaining); (8) supply reel (any standard magnetic tape may be used); (9) recording level indicator; (10) 8 in. speaker; (11) mains on/off and volume control; (12) tone control.

The equipment includes a microphone and an attractive carrying case with removable lid and carrying handle.

FEATURES:

Simplicity of Operation.—Record/Stop/Play, all operated from one control.

Use of Tape rather than Wire.—For better reproduction and elimination of breaking and snarling, tape has almost unlimited life. May be used again and again.

Faithful Reproduction of the character or tone quality of music, speech, and other sounds.

Frictionless Turret Drive to avoid speed variations, resulting in flutter.

Ample Power Output to operate external speaker. Also built-in speaker of adequate size to supply sufficient volume without overloading.

Fast Rewind.—Time indicator or scale to permit rapid selection and replay of any part of recording without moving and replacing tape and reels. Also indication of recording time on reels.

Portability.—Especially for certain users but not at the expense of reproduction quality.

Versatility.—Will record from microphone, phono. pick-up, radio.

EDISWAN CINE-SOUNDMASTER

The fitting and adjustment of the Cine-Soundmaster can be carried out in a matter of minutes, and the device is suitable for use with most 8, 9.5, or 16 mm. projectors. It enables synchronized reproductions, with musical backgrounds or sound effects, to be added to silent films.

A recording tape is employed and may be used over and over again, and there is no limit to the number of times a recording may be played back.

The equipment is supplied with microphone, carrying case, and built-in speaker.

* * *

This new coffe percolator, product of H.M.V. (N.Z.), Ltd., has the following features:—

Finished in highly polished chromium plate on copper; extremely efficient and easily cleaned percolation unit; heatproof black bakelite handle and base; safety device prevents percolator boiling dry; special non-drip spout for ease in pouring; capacity, eight coffee cups or just over one pint. Trade inquiries should be addressed to: His Master's Voice (N.Z.), Ltd., Head Office, P.O. Box 108, Wellington.

MESSAGE TO AUSTRALIAN READERS

We have to inform our Australian readers that this will be the last issue of *Radio and Electronics* to be exported to their country.

In case this may come as a surprise to some, we would like to point out that the exporting of copies to Australia has always been regarded as a temporary measure only. We have considered for a long time that the best way to distribute this journal in Australia would be to print it in that country, with Australian advertising, amateur and DX notes, etc., but without such material as may be of interest to New Zealand readers only.

With that end in view, negotiations are in progress for the purchase of an Australian magazine which has been very well known for a number of years under the name of the *Australasian Radio World*. These negotiations are almost complete, and our plans with respect to the two magazines are as follows:—

(1) The last appearance of the *Australasian Radio World*, as such will be the December, 1950, issue. Thereafter its name will be changed to *Australian Radio and Electronics* (incorporating the *Australasian Radio World*).

(2) The new magazine will make its first appearance in January, 1951, and will be identical with the New Zealand issue of *Radio and Electronics*, except that it will contain Australian advertising and will retain the purely Australian features of the old *Radio World*.

(3) As mentioned above, after the present issue, no further copies of *Radio and Electronics* will be exported to Australia except those in fulfilment of annual subscriptions placed in New Zealand with our own office.

We would ask all readers of *Radio and Electronics* in Australia to transfer their allegiance to the new *Australian Radio and Electronics*, which, as we have indicated, should make its first appearance in lieu of the January, 1951, issue of the *Australasian Radio World*.

There is one article which has been running serially in this journal for several months, and which will not be finished until the next issue. Obviously this cannot be published in the new *Australian Radio and Electronics*, since a large number of new readers will not have seen the previous instalments. Accordingly, we are arranging for loose-leaf reprints of the final instalment of the "Senior Communications Receiver" to be sent to our Australian office in Sydney, whence copies may be obtained, free of charge, on request. This, we hope, will satisfy those of our present readers who otherwise would not be able to see the last instalment of the article.

We would also like to mention a new series of articles, the first of which has already appeared—namely, that entitled "The *Radio and Electronics* Television Project." Since only one instalment of this series has appeared, and because we think it will be of considerable interest in Australia, we are re-commencing the series in *Australian Radio and Electronics*. For this reason, Part 1 of the

(Continued on Page 47.)

N.Z.R.T.M.F. Christmas Message

Mr. T. J. F. Spencer

During the latter part of 1950, the general public, as well as those connected with the radio industry, have become increasingly aware that television is rapidly coming closer to New Zealand.

Radio manufacturers are ready and willing to make television receivers just as soon as the Government can be persuaded to commence a television service.

The members of the New Zealand Radio and Television Manufacturers' Federation believe, moreover, that the service should be commenced with nothing less than full main centre coverage, all experimental work having already been covered many times in those countries where TV now operates.

We therefore look forward to 1951 as the year which may see this service well on the way to becoming an accomplished fact as well as a year of advanced technical development and expansion of sound broadcasting and reception techniques.

May I wish all members of the Federation and all those connected with the radio industry a Happy Christmas and a Bright and Prosperous New Year.

T. J. F. SPENCER, *President.*

* * *

N.Z. Radio Traders' Federation Christmas Message

Mr. J. Fairclough

In appreciating this opportunity of greeting all in the radio trade, especially traders, may I trust that 1950, which is rapidly drawing to a close, has, despite its difficulties, problems, more competitive business, etc., proved a highly satisfactory year.

The coming year 1951 is going to have many fresh problems, for the trade in general and I would stress upon traders throughout New Zealand the great benefit of being associated with this Federation, which during the past year, under the guidance of some of the wisest men in the trade, has met with quite a measure of success and watched the interests of members throughout 1950.

I wish all members of the Federation and all readers of this journal, associated in any way with the radio trade, a Merry Christmas and a Prosperous 1951

J. FAIRCLOUGH, *President.*

* * *

The lines below were inadvertently omitted from the account of the proceedings of the R.T.M.F. Conference, and should have appeared at the top of page 26.

of the Commission dealt with matters affecting many New Zealand industries other than the radio industry, and in spite of the fact that these other industries stood to gain considerable benefits when the recommendations of the Commission were framed into suitable legislation, the radio industry was the only one which had made submissions, so that it can be said that the Federation's efforts in this direction had been entirely unaided.

The potential benefits resulting from the Commission's recommendations would not be felt, however, until such time as the Government framed and passed legislation in accordance with those recommendations. The Federation will, therefore, pursue the matter further, and attempt to have the legislation brought down as soon as possible.

MESSAGE TO AUSTRALIAN READERS

(Continued from Page 44.)

series will have been seen before by those readers who have transferred their attentions from the New Zealand publication to the Australian version. We trust, therefore, that these readers will bear with us in this single case of repetition. When the change-over is completed, Australian readers can rest assured that in buying the new magazine they are getting exactly the same technical material as is published month by month in the parent New Zealand paper.

CLASSIFIED ADVERTISEMENTS

Rates are 3d. a word, with a minimum charge of 2s. Advertisements must be to hand in this office not later than the tenth day of the month in order to be published in the issue appearing at the beginning of the following month.

While all care will be taken, no responsibility can be accepted for errors. Advertisements should therefore be submitted either typed or printed in block letters.

EXCHANGE 12 volt/300 volt 60 ma. Genemotor for similar 6 volt unit. Reply C. H. Turner, Civil Aviation Branch, Air Department, Wellington.

REWARD for information concerning "Motorola" Playmate Portable Radio, Model 5A7A, 8 in. x 5 in. x 5 in., Serial No. 68015, 110v. A.C./D.C. and batteries, maroon case, chromium trim, using valves 1R5, 1UW, 1S5, 3S4. Write "Motorola" care this paper.

Tape Recording

(Continued from Page 13.)

sally used is that of passing the material to be demagnetized through a decreasing alternating field until this is gradually reduced to zero. In order to demagnetize the tape properly, it must pass through several reversals of field polarity in its passage through the head, and for this reason the gap is made wide and the frequency high. Since we already have to have a high-frequency oscillator to supply the recording bias, it is practical and economical to use the same oscillator for exciting the erasing head. The only difficulty that arises is that a high current must be passed through the erasing head's coils, because, first, the erasing field must take the tape to saturation in both directions, and, secondly, because more current is needed in order to do this, owing to the extra wide gap of the erasing head. The difficulty encountered is that considerable power must be used at the erasing frequency, and this sometimes results in over-heating of the erase head. It is possible to use low-frequency erasing —for example, by making use of the mains frequency, but this makes it difficult to carry out erasure while a recording is being made, because the large field from the 50 c/sec. erase head is hard to keep out of the recording head.

* * *

Philips Experimenter

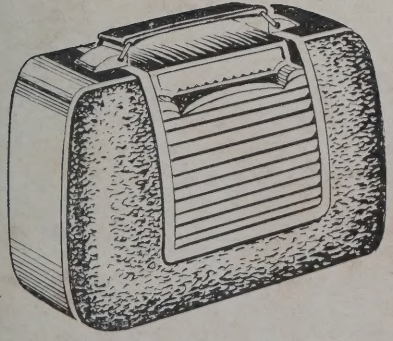
(Continued from Page 41.)

ting one wire go after they have both been terminated. This was found to give just too much inductance, and final adjustment was made by spreading the bottom turn away from the rest of the coil, and then doping it in position with polystyrene dope. No trouble will be experienced from the centre turns of the coil shifting, but the top four or five turns were doped as well as the few at the bottom to prevent all possibility of their shifting as time goes on.

This completes the building instructions; the third and final instalment will describe the setting-up and use of the frequency meter.

You can use a PORTABLE RADIO anywhere

Greater enjoyment for all the family—when you take a PORTABLE RADIO. At the beach, tennis, races, camping, gardening—anywhere you go—go with a Portable Radio. Get one now—either a Personal Portable to slip in your pocket—or the regular-size Portable Radio.



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THE FAMOUS "Q-MAX"

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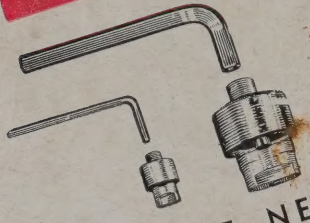
The Q.T/17 is an improved version of the famous "Q-MAX" Q.5/10. It embodies the following features:—

17 Valves
Double Super Heterodyne
Continuous coverage—160 kilocycles to 60 megacycles
Variable selectivity (band width adjustable 200 cycles to 15 kilocycles)
High signal to noise ratio
Voltage stabilizer
Crystal Calibrator
Signal Strength Meter
Noise Limiter
Beat Frequency Oscillator
Push-pull Output to 10 watts
Negative Feed-back with Low Distortion.



AND THE NEW "Q-MAX" CHASSIS CUTTER

The new "Q-MAX" Chassis Cutter consists of three parts: a die, a punch, and an Allen screw. Operation is simple—

1. Drill a hole to clear the Allen screw.
2. Insert Allen screw through die and pass the screw through hole.
3. Screw the punch on the projecting Allen screw until it makes contact with the metal to be cut.
4. The Allen screw is then turned by means of a key provided, and the punch will cut cleanly and evenly through the metal.

Sizes range from $\frac{5}{8}$ in. to $1\frac{1}{2}$ in. (1 in. sq. is also available). The same size Allen Key fits the $1\frac{1}{8}$ in., the $1\frac{1}{4}$ in., and the $1\frac{1}{2}$ in.

Inquiries welcome. Quotations can be given immediately.

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